

## Nonpharmacological Management of Excess Weight, Obesity and Diabetes

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### Abstract

Excess weight and obesity were considered disease of affluence for centuries. These metabolic diseases are now driving the global diabetes epidemic. With over 1.1 billion obese individuals, obesity has doubled, and the diabetes has increased four-fold worldwide. The increased risk of diabetes (80%-85%), can be attributed to excess weight and obesity, with abdominal fat distribution. Excess weight initially affected the middle class, the first socially mobile group, to experience the affluent sedentary lifestyle. Now we see a cluster of metabolic diseases, excess weight, obesity, and high blood pressure, which are no longer confined to the wealthy. Ancient traditional medical systems (India, China and Tibet), consider that the metabolic alterations, inherited or acquired, leads to metabolic risks (Doshas) and therefore, the holistic approach was to manage these “Doshas” and normalize the physiology. To a great extent, it was preventive than therapeutic. Western medicine on the other hand, being disease centric, focused on the management of observed risk factors, rather than treating the disease. This approach was more appealing to people, than the holistic approach of preventive medicine. Over the years, a not so good attitude has developed at the population level, to ignore the healthy lifestyle, which is preventive, and count on the curative effect of medical interventions, after the development of risk factors for metabolic diseases have been diagnosed. In view of this general attitude, no country has been able to reduce or reverse the increase in the incidence of metabolic diseases. Professor Majid Ezzati, from the School of Public Health at Imperial College London, who led the research study on the data of 199 countries, between 1980 and 2008 with the Harvard School of Public Health and Worldwide Collaborators, says: “This study shows that non-communicable diseases are no longer ‘disease of affluence.’ they have shifted from being epidemic in rich countries, to become a truly international pandemic.” In this overview, we will discuss some nonpharmacological approaches, and present our views on this topic of great public health importance.

### 1. Introduction

Framingham Heart Study (FHS), initiated some seventy years ago, by the National Heart Lung and Blood Institutes in collaboration with the Boston University School of Medicine, over the years developed information on the modifiable risk factors that promote cardiovascular diseases [1]. At that time, it was the first long-term study of its kind. Professor Ancel Keys in Minnesota was also setting up a three-decade long epidemiology study. This was the first study to investigate diet and lifestyle, along with other risk factors for cardiovascular diseases (CVDs), in fifteen cohorts in seven countries (four

regions) from 1958 to 1964. In Key's publications, he details the reasoning for inclusion of the seven countries [2]. Namely, these were the countries that could provide the funding and infrastructure necessary to complete the research. According to Professor Luepker of the University of Minnesota, the WHO Multinational **MON**itoring of trends and determinants in **C**ardiovascular disease (MONICA) project, was the most comprehensive approach, to better understanding disease etiology, incidence and trends at the population level [3]. MONICA took place in Europe, but included centers in the USA, Canada, China and Australia. The study began in 1979 and enrolled investigators from 26 countries, of which 21 completed the full study. Ten-year results from 37 of the populations participating in MONICA, indicated that the decline in CVD was genuine. The largest decrease in coronary-event rates occurred in two northern European populations in Finland, North Karelia and Kuopio province. According to the epidemiologists of the Imperial College London, between 1980 and 2009, age-standardized cardiometabolic mortality declined in all 26 countries, whereas, diabetes mortality increased in high-income countries [3].

During the same period between 1980 and 2009, according to Global Burden of Disease Collaborators, incidence of Obesity has doubled to over 1.1 billion and diabetes, four-fold worldwide [4-8]. China and India, countries with the largest populations, have taken over as serious contenders for the number one spot, as far as the diabetes incidence is concerned [9-11]. According to the Chinese researchers, since 1980, the rate of increase in the incidence of diabetes in China has risen 17-fold. All of the major multinational studies concentrated their efforts in Europe or in Western countries. There is hardly any major clinical study from the Asian subcontinent, where the increase in the incidence of metabolic diseases have reached epidemic proportions. A major systematic analysis of the data by Shen and associates from China, attribute this phenomenal rise in the diabetes in China, to social and economic development, urbanization, dietary pattern, and Westernized life style [12]. In parallel with the increase in diabetes, prevalence of overweight and obesity among Chinese adults aged 18 years or older, increased from 14.6 % to 35% between 1992 and 2010. According to the Harvard School of Public Health (2017), globally, noncommunicable disease result in 65% of all deaths, and the global economic burden has been estimated at 47 trillion dollars during 2010 to 2030 [10]. Furthermore, they predict that the incidence of these metabolic diseases is likely to rise significantly over the coming decades, contrary to the expectation of the Millennium Development Goals, of reducing the level at 2025, to the level of 2020.

## 2. Discussion

When it comes to nonpharmacological approaches, the management of chronic diseases, such as hypertension, excess weight, obesity, and type-diabetes, we are left with just a few choices, - healthy diet, and exercise and lifestyle changes. Professor Salim Yusuf and associates at the McMaster University, Canada, did a case-control study of acute myocardial infarction (MI) in 52 countries, representing every inhabited continent [13]. Based on the results of this seminal study the authors concluded, "Abnormal lipids, smoking, hypertension, diabetes, abdominal obesity, psychosocial factors, consumption of fruits, vegetables, and alcohol, and regular physical activity account for most of the risk of MI worldwide in both sexes and at all ages in all regions. This finding suggests that approaches to prevention can be based on similar principles worldwide [13,14]." Khera and associates from the Massachusetts General Hospital, Boston, demonstrated, that in spite of genetic risk, adherence to a healthy life style could offset future risk for CVD (15). Genomewide association analyses have identified 50 independent loci associated with risk of coronary artery disease. Using aggregates of these risk alleles into a polygenic risk score, Khera and associates studied the importance of healthy life style on future CVD risks in four studies, involving 56,000

participants. Based on the results of this study, the authors concluded that adherence to a healthy lifestyle was associated with significantly (>50%) reduced risk of coronary artery disease within each category of genetic risk [15].

The American Heart Association (AHA) in its most recent (July 2018) Diet and Lifestyle recommendation, suggests following guidelines: Start by knowing how many calories you should be eating and drinking to maintain your weight. Nutrition and calorie information on food labels is typically based on a 2,000-calorie diet. You may need fewer or more calories depending on several factors including age, gender, and level of physical activity. If you are trying not to gain weight, don't eat more calories than you know you can burn up every day. Increase the amount and intensity of your physical activity, to match the number of calories you take in. Aim for at least 150 minutes of moderate physical activity or 75 minutes of vigorous physical activity – or an equal combination of both-each week. Allison Gray in his article on Nutritional recommendations for individuals with diabetes says, “The key take home message is that the 1800 calorie ADA diet is dead! The modern diet for the individual with diabetes is based on the concepts from clinical research, portion control, and individualized lifestyle changes [9]. When it comes to an ideal diet plan for the management of excess weight, obesity and diabetes, there is considerable controversy at present. Patients are better off to go along with the personal clinician's recommendation, rather than to try and find, an ideal diet by Internet search.

Professor Roy Taylor of the University of New Castle, UK, says that reversal of type-2 diabetes to normal metabolic control, by either bariatric surgery or hypocaloric diet, allows for the time sequence of underlying pathophysiologic mechanisms to be observed [16]. He summarizes his findings the following way: “Type 2 diabetes has long been regarded as inevitably progressive, requiring increasing number of oral hypoglycemic agents and eventually insulin, but it is now certain, that the disease process can be halted with the restoration of normal carbohydrate and fat metabolism. Type-2 diabetes can be understood, as a potentially reversible metabolic state precipitated by the single cause of chronic excess intraorgan fat.” In view of such observations, there is considerable interest in dietary therapies aimed at low calorie weight loss programs. One such program, which is gaining considerable interest is the Ketogenic diet, weight loss and management of type-2 diabetes [17]. David S, Ludwig, a Professor of Pediatrics and Nutrition at Harvard School of Public Health says, “It is hard to lose weight, but it is much harder to maintain that weight loss, because of well-described physiological adaptations.” In a recent article on this topic in JAMA, the author summarizes a meta-analysis of 13 randomized controlled trials, which suggested that people on ketogenic diets tend to lose more weight and keep more of it off, than people on low fat diets [17].

Now that we have discussed two independent dietary studies, that promote the benefits of low carbohydrate or hypocaloric diet for weight loss and diabetes management, let us consider some controversies about such dietary changes, on long-term objectives. Professor Maciej Banach of Medical University Lodz examined the association between low-carb diets and the risk of death for CVD, among 25,000 individuals who had participated in the National Health and Nutritional Examination Survey (NHANES) in 1999-2010. In a second part of the same study, these researchers examined the associations of the same events in a large meta-analysis, which summarized the data on 450,000 individuals followed over 15 years. Overall, they found that those who consumed the least amount of carbohydrates were 32% more likely to die prematurely from any cause. Also, low-carb consumers were 51% more likely to die from CVD, and 50% more likely to die from cerebrovascular disease. The study was presented recently (Sept 2018), at the Congress of the European Society of Cardiology in Germany. Diet and Nutrition are the most controversial topics, when it comes to the management of excess weight, obesity and

diabetes. European and Canadian guidelines continue to recommend 45-60% of the total energy from carbohydrates, 10-20% as protein, less than 35% as fat. Indian guidelines recommend 50-60% energy from carbohydrates, 10-15% as protein, and 30% from fat. In contrast, as we have mentioned earlier, the American Diabetes Association (ADA) concluded, that there is no ideal mix of macronutrients for all people and recommended tailored goals [18].

Most dietary guidelines are derived from studies done in Western countries. As we have discussed earlier, majority of developing countries, were not included in any major multinational surveys. There is no demographic specific, or ethnicity specific, guidelines or guidance statements for the general population worldwide. The facts, that even a professional society like ADA, recommends a tailored goal indicates, that they are not thinking of population at large, and are focusing on the management of these diseases at the level of an individual. On the other hand, American Heart Association (AHA) diet and lifestyle recommendation (July 27, 2018), lists the overall dietary healthy pattern as follows: a variety of fruits and nuts; whole grains; low-fat dairy products; skinless poultry and non-fried fish; nuts and legumes; non-tropical vegetable oils. In one of the earlier articles, we have discussed studies at the population level behavioral modifications, implemented in the two provinces of Finland [19]. I am discussing these studies again, to illustrate a very successful story in epidemiology. One of the seminal studies on the CVD prevention, at the population level was the Finnish study, done at North Karelia in Finland [20-23]. According to "Pekka Puska Reports, "Prevention in Action", in 1960s, Finland had the highest rate of deaths from coronary artery disease, especially in the province of North Karelia. In 1971, representatives of the Province signed an appeal to the National Authorities for urgent help to reduce the burden of CVDs in this area. Finnish authorities, with the help of WHO, launched The North Karelia Project: Thirty Years Successfully Preventing Chronic Diseases. At the time of launch several studies including the findings from FHS, had pointed out the importance of risk factors such as high LDL- cholesterol high blood pressure and tobacco use.

These studies had demonstrated the strong influence of diet, especially the quality and quantity of dietary fat, on the levels of blood cholesterol. Smoking was quite common in this population. A high intake of salt, saturated fat, and low intake of vegetables were the cause of high blood cholesterol and high blood pressure in this population. The aim of this project was, to change the general risk-related life styles, through community-based actions. Over the 30-year period, there were significant changes in the life style of this population. At the beginning of this project all people used butter on their bread and in cooking. Nowadays, according to the report less than 5% of people use butter on bread and around 60% of the households, use vegetable oil for cooking. According to Pekka Puska Report, the age-standardized mortality rate for coronary heart disease among men in North Karelia in 2006 was 85% lower than during the period 1969-71; nationally, the reduction was a whopping 80%. The North Karelia project was the first and one of a kind comprehensive community-based program, to demonstrate a positive impact on CVD death and disability. However, there were several earlier population-based studies, which also had shown observation-based correlation between choice of diet and CVD risks. As we have mentioned earlier, in the MONICA study the two province of Finland showed significant decline in the CVD deaths because of its National efforts.

In the chain of events, that lead to the acute vascular events, such as heart attacks and stroke, excess weight, obesity, and diabetes play a significant role. We have so far discussed some of the efforts related, to the dietary management of diabetes. When it comes to the management of excess weight, and obesity, comprehensive lifestyle interventions, including nutrition, physical activity, and behavioral therapy are critical. The American college of Cardiology, the American Heart Association,

and Obesity Society have published joint guidelines that provide evidence-based recommendations, for comprehensive lifestyle management. The primary target for dietary management is, to create an energy deficit by addressing caloric intake. A caloric reduction of 500 to 700 calories per day is recommended for moderate weight loss. In addition, for energy expenditure, aerobic exercise or physical activity of at least 30 minutes of brisk walking, on most of the day of the week is recommended. Studies that have shown benefits of low calorie or hypocaloric diets are short term studies.

A study that was reported in N. Engl. J. Med (2003) showed, that people who followed a low-carb diet. lost more weight than those on a low-fat diet after 6 months [24,25]. The authors noted, that “longer studies are required to determine the long-term safety and efficacy of low- carb, high- protein, high-fat diets.” A recent study done in four US communities reported, that both high-carb and low-carb diets were associated with increased mortality, with minimal risk observed at 50-55% carbohydrate intake [25]. As we have mentioned in many of our earlier articles, all major metabolic diseases, are more or less managed well, after the risk factors are diagnosed [26-29]. No one disputes about this approach. Having said that, public health personnel view enhanced population well-being, as the primary goal. Early scholars in public health, advocated that focusing on the highest-risk people, would yield the greatest population health. However, it is worth considering, whether a focus on a disease’s root cause is better, for interventions tailored to specific cluster of metabolic diseases. However, there is a recent emerging trend, with broader emphasis on using vast amounts of data, to serve “precision” ends, incorporating genomics as one of the many other associated fields of relevant technologies and innovations [30]. In May of this year National Institutes of Health (NIH) USA, began enrollment of a vast medical research cohort. Named “All of US,” it is meant to include 1 million U.S volunteers, who will be studied over 10 years at a cost of 1.45 billion. According an article in NEJM, the project promises to “lay the scientific foundation for a new era of personalized, highly effective health care,” a counterpart to previous “one size fits all” medicine [30].”

The efforts of the prestigious National Institutes of Health of the USA to recruit million people for a long-term study is laudable. However, as we already have observed in earlier attempts of using emerging technologies such as, stem cell therapies, gene therapies, cellular and molecular therapies, the success have been limited and these emerging technologies are not yet ready for application at population levels. What we need just now is, immediate development of policies and strategies, that can be implemented at population level. Ezzati and associates of School of Public Health, Imperial College London, in their seminal article in Science, summarize their views from lessons learned from population-based studies in the following way, “Effective approaches for large-scale prevention of metabolic diseases should include, intervention of modifiable risks, tobacco control, alcohol control through taxes, regulation of sales, advertisements; reducing dietary salt, unhealthy fats, and sugars through well-designed public education; increasing the consumption of fresh fruits and vegetables, healthy fats, and whole grains by lowering and improving availability; implementing a universal, effective, and equitable primary-care system that reduces modifiable risk factors for metabolic diseases [31,32].” In a short review like this, it is hard to cover all aspects of non-pharmacological approaches, to the management and prevention of metabolic diseases, readers are urged to refer to original articles and reviews for additional information [33-45].

### 3. Conclusions

Metabolic diseases, such as hypertension, excess weight, obesity, and diabetes have reached epidemic proportions worldwide. Public health experts do not see any end, to this increase in incidence of these diseases in the near future. To a

large extent, discovery of modifiable risk factors created a false assurance, that everything will be OK, as far as observed risks can be managed by appropriate interventions. In a way, this assumption may be true, because modifiable risk reduction or prevention, to a great extent slows down development of clinical complications, and the occurrence of acute vascular events. Having said that, we cannot modify a risk unless the risk is diagnosed, hence this process does not contribute significantly, to primary prevention or primordial prevention. Primary prevention at the population level is hard and is dependent on the dedication and efforts of multiple stakeholders. China and India two countries, with the largest populations, with varied demography and ethnic diversity, serve as classical examples for the impact of the progress in socioeconomic conditions, on the rate in the rise of metabolic diseases. In view of the large populations in these countries, screening of all individuals for the early diagnosis for the risks and providing appropriate intervention, poses a huge public health program.

Why did we select this topic for our discussion? Can we really solve the public health and economic burden imposed by these epidemics? Is anyone paying attention to this ever-growing public health problem, which is associated with urbanization, economic progress, sedentary habits and unhealthy lifestyle? There is an urgent need for policies and strategies that can reduce or prevent these metabolic diseases at the population level. In the article in **Science**, Ezzati and associates include interventions of modifiable risk factors as one of the immediate needs in the prevention strategies. We however, feel that intervention of modifiable risks only prevents or postpones the clinical complications or acute vascular events, but these interventions will not reduce, reverse, or prevent the rate of increase of these metabolic diseases. In view of this dilemma, we have in this overview discussed nonpharmacological approaches for reduction, reversal or prevention of metabolic diseases. Just in the past three decades obesity has doubled, diabetes has increased four-fold worldwide. Experts are of the opinion, that we will not see any decrease in this trend. Just imagine the burden of these two epidemics in the next three decades, if the increase in the incidence of these diseases continues at this rate?

As we have mentioned earlier in this essay, when it comes to nonpharmacological approaches to the reduction, reversal, or prevention of these metabolic diseases, healthy diet, exercise, and lifestyle changes stand out as the best choices. We have mentioned the seminal works (INTERHEART) of Professor Salim Yusuf and associates from McMaster University, as well as the studies by Harvard group, by Professor Khera and associates on the effect of lifestyle changes, on modifiable risks and the beneficial outcomes. We also discussed the MONICA Studies, Seven Countries Studies, and the Finland studies. In view of the meticulous population-based studies initiated in Finland and the success achieved in these studies, we have stressed the importance of these studies, in the design of future studies. We have discussed the very general nature of the guidelines and guidance statements by the professional societies, when it comes to diet, exercise, and lifestyle changes. We also have discussed the studies by Professor Roy Taylor and associates at New Castle University, demonstrating the reversal of diabetes by low carbohydrate or low caloric diets. Since most of the dietary studies are short-term studies, experts have suggested long-term studies to check safety and efficacy of these dietary interventions.

To add to these confusions, some of the long-term observations have reported, increase mortality associated with both low-carb as well as high-carb diets. We sincerely hope that questions raised, and controversies discussed, will encourage the readers, scientists, clinicians, policy makers and public health professionals to pay attention to this “tsunami of metabolic diseases” and come up with novel approaches for reduction, reversal and prevention.

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