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CALORIE RESTRICTION WITH PROPHETIC CONTROL DIET ETIQUETTES BEAR BENEFITS FOR HUMANKIND: A REVIEW

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The sole author designed, analyzed, interpreted and prepared the manuscript.

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Review Article

ABSTRACT

Calorie Restriction (CR) is a dietary regimen with no malnutrition. Dieting is significant in maintaining a healthy life. Unfortunately most of our health problems like obesity, cardiovascular diseases, high blood pressure, diabetes etc are linked mainly to unhealthy diet. In various studies on human beings, CR has ensured the realization of various benefits pertaining to health like reduction of abdominal fat mass, increase in insulin sensitivity, lowering in body temperature, decrease in metabolic rate and reduction of the levels of pro-inflammatory cytokines, reactive oxygen species (ROS) and atherosclerotic lipids in blood. The prophetic way of eating i.e the Sunnah way of eating is very comprehensive and has been found to be in perfect agreement with CR. As dramatic worsening in dietary behaviors at global level, over the past few decades, has led to the increased trends in several metabolic risk factors, causing deaths and disability worldwide, and the people are not realizing that the largely preventable factors/behaviors like physical inactivity and overeating can make the difference if unpracticed. Religion can play a very important role in maintaining our health by providing emotional support and motivation. The present review aims at gathering refocus on CR that being a very significant and much needed, health-friendly factor. Also the effort has been made to increase emphasis upon CR by seeking motivation from the prophetic control diet etiquettes for healthy living.

Keywords: Moderate eating; NCDs; Dietary regimen; Sunnah.

1. INTRODUCTION

Calorie restriction (CR) is defined as a dietary regimen with no malnutrition. It is characterized by low calories intake while preserving normal supplement of vitamins, minerals and essential biomolecules [1]. Calorie Restriction was first of all reported by Crowell and McCay in 1935 when they

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demonstrated that by simple reduction of malnutrition free caloric intake in rats almost doubled their lifespan [2]. This provided an experimental model, demonstrating that aging can be slowed down. After about half a century, Walford and Weindruch did report that caloric restriction being "adult-initiated" and started at 12 months of age in rats, both increased their lifespan and reduced the incidence of cancer by more than 50% [3,4]. In several model organisms ranging from unicellular yeast to worms, flies, rodents, and primates, continuous studies of many decades have confirmed that Calorie Restriction effects positively on the healthspan and lifespan [5].

Lifespan refers to the deterioration of body cells with age whereas health span refers to disease free age. CR extends healthspan by retarding different age-associated diseases such as cardiovascular diseases, atherosclerosis, diabetes, cancers and neurodegenerative diseases [6,7]. In mammals including human beings, CR has ensured the realization of various blessings pertaining to health like reduction of abdominal fat mass, increase in insulin sensitivity, lowering in body temperature, decrease in metabolic rate, reduction of the levels of pro-inflammatory cytokines, reactive oxygen species (ROS) and atherosclerotic lipids in blood [8,9,10] and many more. However, there still exists controversy over the mechanism by which CR counteracts the deleterious effects of aging.

It is very unfortunate that, today, most of our health problems are linked to unhealthy diet. For example obesity, coronary artery diseases, high blood pressure, iron deficiency, anemia, tooth decay, intestinal problems etc. Such problems are mainly because of consumption of too much food, salt, sugar, smoking or too much stress, alcoholism etc. Giving up excessive food, salt, sugar, cholesterol, drinking and smoking will ensure the safety of our healthspan and prevent rusting of our heart and arteries from inside [11]. We need a well balanced diet along with limited consumption of junk foods for better health. Junk foods contain high sugar fat and salt content. We require a healthy diet and healthy diet is one of moderation. It does not necessarily mean cutting out certain foods completely or limiting oneself only with some raw vegetables. Here attention is given to the comparison between the number of calories taken in and burnt. A proper adjustment on both sides of the equation of dieting and exercise is needed to be maintained for better lifestyle [12].

The concept of CR got well applied through the Sunnah of Prophet Muhammad Peace Be Upon Him (PBUH) fourteen centuries ago. Sunnah follows Quran as the source of Islamic legislation. The Prophet Muhammad (PBUH), the last and final messenger of Islam, was sent to guide humanity. The prophet acts as the role model for his followers. Everything from the side of prophet is considered as his Sunnah [13]. Therefore, everything done by the Prophet or by his companions and agreed by the Prophet, acts as the source of Islamic teachings. For human wellbeing, the Sunnah way of eating has been discussed widely as the best way to follow. The claim can be justified for the reason being that throughout the life time, Prophet Muhammad (PBUH) was never diagnosed with any disease [14].

The prophetic etiquettes of control diet are very comprehensive and in perfect agreement with CR. They teach eating in small amount, eating slowly and avoiding gluttonies. However, unexpectedly, many muslims, claiming to be the followers of these Sunnah, not follow these rules and hence are overweight and obese [13].

The recent approach of using faith-based elements in researches is making its place because faith based genuine elements can act as a good mediator to change people's behavior. Religion is used as an added value by several interventions of weight loss program these days. Islamic teachings can act as good faith-based interventions to motivate the people in order to change dietary behavior for controlling weight [15,16]. Religion can play a very important role in maintaining our health by providing moral & emotional support and motivation. Raising awareness through the agency of religious intervention can be beneficial [17]. So the effort has been made through the present review to gather refocus on a very significant issue of calorie restriction not only by mentioning research based medical benefits of CR but also by increasing emphasis over it through the Sunnah teachings in this regard. Portraying CR as with many benefits for humanity can act as motivation for many. This paper can act as mediator to change the behavior of people particularly muslims and the muslims compose a large percentage of global population.

Many studies have been done to demonstrate the effects of CR on human beings where the participation on the part of human beings has been either voluntary or involuntary.

2. INVOLUNTARY CALORIE RESTRICTION IN HUMANS

Calorie restriction episodes on involuntary basis have happened many times in history but very rarely has it been without malnutrition. During World War 1 in 1917, Danish government enforced person (men and

women) wise restriction of food nutrients along with adequate consumption of whole grain cereals, vegetables, and milk for two years. This undesired experiment impressively resulted in 34% reduction in death rate [18].

In another such episode in Norway, in World War 2nd, people were forced a calorie restriction without malnutrition by 20% for approximately 4 years (1941–45). Here too, results were impressive and showed drop in population mortality by 30% compared to the pre-war level [19].

3. VOLUNTARY CALORIE RESTRICTION IN HUMANS

US National Institute of Aging initiated the clinical trials of CALERIE (Comprehensive Assessment of Long-term Effects of Reducing Intake of Energy) for studying the long term effects of CR. These were the first controlled clinical trials of CR and characterized by adequate nutrient provision in healthy non-obese humans [20]. CALERIE was done in two phases: Phase 1 and Phase 2. Phase 1 or CALERIE-1 comprised site-specific pilot studies and were done in order to know the effects of CR [21-23]. Phase 1 was followed by phase 2 or CALERIE 2, a multi-centric study, done for 2 years on non-obese men and women (21–50 yrs). Here 25% reduction in energy intake was applied. CALERIE-2 was done to determine whether the effects of CR on lifespan and healthspan of volunteers would be same as that on Rodents [24]. Results of CALERIE 2 were quite satisfactory. They showed positive change in cardiometabolic risk factors, adaptive decreases in daily energy expenditure and decrease in circulating T3 (Triiodothyronine) and TNF-α (Tumor Necrosis Factor); that indicate potential antiaging effects [25]. Little decrease is reported in bone mineral density in the lumbar spine and femoral neck [26]. Also continuous increase in serum insulin-like growth factor (IGF) binding protein-1 is noted with no change in IGF-1 or biologically relevant increases in cortisol [27].

4. VOLUNTARY CALORIE RESTRICTION IN HUMANS AT THE TIME OF PROPHET (PBUH)

A learned physician was sent by a king of Persia to treat the people there in Medina; the state ruled by the Prophet Muhammad (PBUH). To the amazement of physician, no person approached him for treatment for two years together when finally he appeared before Prophet to complain of no patient coming to him for treatment. In reply Prophet Muhammad said: ‘‘It is the custom of these people not to eat until hunger overcomes them and to ceases eating while there still remains a desire for food.’’ The physician exclaimed: This is exactly the reason for their perfect health [28].

5. CALORIE RESTRICTION AND OBSERVED BENEFICIAL EFFECTS

Calorie Restriction has been proved to be a blessing for humankind. It is because huge number of beneficial aspects have been realized through various studies in terms of metabolic benefits, immunological and hormonal changes, epigenetic modifications, neuroprotection, oxidative stress and autophagy, apoptosis & cell survival. What has proved to be the only promising reason for reduction of biological aging in other than human species, has been the practice of Calorie Restriction [29].

Calorie restriction has yielded several positive metabolic effects on various model organisms including humans like it leads to the reduction of metabolic rate in rodents, primates and humans [30-37]. Several studies claim to reduce the body temperature over a span of calorie restriction in Rodents, Primates and Humans [34-36,38,39]. CR has proved to be very beneficial for prevention of Atherosclerosis because it influences the causes of Atherosclerosis in Rodents, Primates and Humans positively [32,34,36,40]. Blood pressure is decreased [41]. Along the line of improvements in glucose homeostasis, CR paves the way for the considerably good reduction in the size of adipocytes in body of Yeast, Rodents, Primates and Humans [32,34,36,39,42-44].

Glucose regulation has shown to get improved in C. elegans, Rodents and Humans [45-48] and also lowering in thyroid function in Humans [39].

Improvement in insulin sensitivity in Rodents, Primates and Humans [30-34,36,37,49] along with increase in β-cell function [50] and reduction in inflammation in Yeasts, Rodents and Mammals [34,42,43] are very important beneficial immunological and hormonal changes that result from CR.

When beneficial aspects of CR in terms of neuroprotection are considered, it leads to decreased Reactive Oxygen Species (ROS) in Yeast, Rodents and Primates [34,35,42,43,45-48,51-53] and Production of antioxidants, DNA repair enzymes and anti-apoptotic protein in Rodents and Primates [35]. Also increased levels of Brain-derived Neurotrophic Factor (BDNF) are reported in Rodents and Humans [32,45,54-59].

The mechanism of Autophagy, Apoptosis and Cell Survival accomplished downregulation of p53 and Foxo proteins (SIRT1) through CR in Yeast, C. elegans, Drosophila, Mammals and Humans [30,60-65] and inhibition of mTOR pathway in C.elegans, Drosophila and Mammals [66-68]. Reduction of oxidative damages through CR have been acquired in Yeast, Rodents and Primates [34,35,42,43,45-48, 51-53].

6. SUNNAH OF CONTROL DIET

Every act, word and confirmation of the Prophet (PBUH) is referred to as his Sunnah. It forms the second source of Islamic legislation after Quran Prophetic control diet etiquettes are part of it [69]. Controlled diet refers to the practice of moderate eating or less eating than normal. Less diet is a unique feature of Islamic civilization. Islam doesn't like overeating and rejects it because it causes various kinds of disorders pertaining to physical, ethical, emotional, intellectual and spiritual nature. Islam gives emphasis upon the control diet. Hazrat Abu Huraira (May Allah be Pleased with Him, MAPH), a companion of the Prophet (PBUH) said that he never saw the Prophet Muhammad (PBUH) disliking any food; he ate when hungry, otherwise left the food. Hazrat Jabir (MAPH) another companion of Prophet (PBUH) reports that Prophet Muhammed (PBUH) said, "Meal of one man would be sufficient for four men". At another place, Hazrat Abu Huraira (MAPH) reported from Prophet (PBUH) that "meal of two persons is sufficient for three and meal of three men would be sufficient for four people". Calories in balance are good for health. Calories intake more than need gets stored in the body as fats, resulting in obesity and this in turn becomes the cause of various abnormalities viz blood pressure, cardiovascular disease. When taste and quantity of food is preferred over control diet, man becomes sick [70].

Muslim should eat in moderation. Islam unrecommends eating or drinking in excess. Muslim should eat only when hungry. Saying of the Prophet (PBUH) reported by Abu Hurairah (MAPH) goes: A Muslim eats in one intestine (that is, he is satisfied with little food), while an unbeliever (kafir) eats in seven intestines (that is, eats a lot). According to the Prophet (PBUH): Nothing is worse than a person who fills (brimfuls) his stomach. Here Prophet (PBUH) puts emphasis on the habit of less eating as it facilitates preventing sickness. Prophet (PBUH) also said: It is enough for the son of Adam to have a few bites (little food) to satisfy his hunger. If he wishes more, it (stomach) should be one third (1/3) for his food, one third (1/3) for his liquid and one third (1/3) for his breath (means 1/3 free/unfilled) [71].

In addition, the Prophet Muhammad (PBUH) recommended that eating should be stopped before the extra room in the stomach (that aids in easy digestion of food) is filled up. The Prophet (PBUH) said: "If you must eat more, be sure that only one third of your stomach is filled with food" [72].

7. DISCUSSION

Imbalance in energy between the Calories taken in and expended results in excessive fat accumulation when more energy is consumed than expended. It causes obesity and overweight that impairs health. Several changes at the global level like consumption of high energy foods rich in fats and sugars, increased physical inactivity, use of advanced modes of transportation, increased urbanization etc have lead to the change in lifestyles at a large scale. Sedentary nature of many forms of works due to the intervention of machinery and technology is adding to the change. Globally obesity has tripled since 1975 and there are more overweight than underweight people in the world. This raised Basal Metabolic Index (BMI) due to more energy intake than consumed, is mainly responsible for major noncommunicable diseases (NCD) viz cardiovascular diseases, diabetes, disorders related to muscles and skeletal system **(**especially osteoarthritis**)**, some cancers etc**.** Cancers may include endometrial, breast, liver, gallbladder, kidney, ovarian, prostate and that of colon. Cardiovascular Diseases (heart diseases and stroke) were the leading cause of death in 2012. Childhood Obesity is also one of the results of raised BMI. Childhood obesity may cause premature death and adulthood disability. In addition, breathing difficulties, hypertension, early signs of cardiovascular disease, insulin resistance and psychological effects are experienced by such children. They are also prone to fractures [73].

The unprecedented change of social and economic nature at the global level has certainly influenced dietary patterns and physical activity which in turn has led to the dramatic rise in NCDs [74]. Keeping all other causes like infections, injuries, suicides etc on one side, NCDs comparatively cause more deaths and it is projected that these deaths may increase from 38 million in 2012 to about 52 million by 2030. Major portion of about 82% NCD deaths is shared by cardiovascular diseases, cancer, diabetes and chronic respiratory diseases. A good chunk of approximately 42% of all NCD deaths globally before the age of 70 years is quite surprising [75].

As dramatic worsening in dietary behaviors at global level, over the past few decades [76], has led to the increased trends in several metabolic risk factors, causing deaths and disability worldwide [77,78] and

the people are not realizing that the largely preventable factors/behaviors like physical inactivity and overeating can make the difference if unpracticed. These preventable factors are unfortunately responsible for four key metabolic changes viz raised blood pressure, overweight/obesity, raised blood glucose, and raised blood lipids [79]. Such key metabolic changes can cause life threatening diseases like ischemic heart disease, stroke, cancer, type 2 diabetes, osteoporosis etc which most centenarians are able to avoid, postpone or overcome [80]. Japan is the leader in case of centenarians among the group of countries with low mortality [81].

However just one year data of NCDs given below can indicate the situation that how serious the issue of NCDs has been as they are, by far the leading cause of deaths worldwide. In 2016 alone, NCDs caused 71% (41 million) of the 57 million deaths that occurred globally. The major NCDs responsible for these deaths included cardiovascular diseases (17.9 million deaths); cancers (9 million deaths; diabetes (1.6 million deaths) and the chronic respiratory diseases (3.8 million deaths); comprising total of 32.3 million deaths. It composed 57% of global deaths (Table 1). The percentage share of these deaths in total NCD deaths or global deaths in the year of 2016 is given in the table. It is worth mentioning here that 75% of premature adult deaths (30–69 years) occurred by NCDs. The probability of death due to one of the four main NCDs in 2016 was 18%, with probability for males and females as (22%) and (15%) [82].

Several studies on humans like the CALERIE trials, the Biosphere-2, CRON (CR with optimal nutrition) studies etc clearly indicate that human health is improved by moderate CR with adequate nutrition while multiple metabolic factors typical of Western countries like type 2 diabetes, heart and cerebrovascular disease, and cancer are drastically reduced. Better side of this CR is that in case of severe CR the accumulation of molecular damage with age gets slower or even reverted with preserving some key physiological functions like left ventricular diastolic function and heart rate variability at a younger stage [83-86].

There are certain volunteers, who are the members of the Calorie Restriction Society and are undergoing severe CR with optimal nutrition (CRON) for prolonging their healthy lifespan. Volunteers are very lean (BMI 19.7±1.8 kg/m2), restricting their calorie intake for about 15 yrs to about 1800 kcal per day i.e about 30% less energy as compared to the men and women feeding on a regular western diet. It is notable here that the volunteers undergoing CRON, feed on undernutrition free diet. The results are quite satisfactory. They indicate that there is reduction in metabolic and hormonal risk factors necessary for type 2 diabetes, cardiovascular disease, stroke, cancer and vascular dementia. Remarkably low values of all cardiometabolic risk factors are reported in the members of the CR Society [87].

Good cholesterol-HDL (High Density Lipoprotein) ratio and quite low systolic, diastolic blood pressure (110/70 mmHg) is seen even in people in their late 70s. C-reactive protein value is almost negligible [84,87]. Remarkable reduction in the values of Serum TNFα, IL6 (Interleukin 6), fasting glucose and insulin is seen along with high improvement in insulin sensitivity [88]. CRONies possessed heart rate variability comparable with 20 years younger healthy men and women [85].

At a molecular level the pathways such as the PI3K/AKT and AMPK/SIRT, which modulate the accumulation of molecular damage were changed in CRONies to an extent that resembles younger individuals [83].

Lower concentrations of Triiodothyronine and as a consequence of it 24 hr body temperature was significantly lower in terms of its value [89]. Lower values of total and free testosterone and estradiol in comparison to higher values of serum SHBG (Sex Hormone Binding Globulin), adiponectin and cortisol concentration in the CR group were reported.

However, unlike in rodents in which CR decreases circulating IGF-1 (Insulin like Growth Factor 1) levels by ~20–40%, even in these individuals severe CR did not decrease total IGF-1 or IGF-1/IGFBP-3 (Insulin like Growth Factor Binding Protein-3) ratio levels, unless protein intake was also reduced [90,91]. At molecular levels metabolic pathways that modulate the accumulation of molecular damage such as the PI3K/AKT and AMPK/SIRT pathway, were changed by CR to an extent that resembles younger individuals; which again indicates the anti-aging potential of CR [83]. In particular, AKT mRNA expression and protein phosphorylation were significantly reduced by CR in the skeletal muscle and transcription factors downstream of AKT such as FOXO-3A and FOXO-4, were up-regulated. FOXO activation resulted in up-regulation of several anti-aging genes including the antioxidant enzyme SOD2, the DNA repair transcript DDB1 and the autophagy genes beclin-1 and LC3 [80]. Consistent with some of these gene expression changes, beclin-1 and LC3 protein levels were significantly higher in the skeletal muscle of the CR volunteers [86]. Moreover, key

Table1. Showing major NCDs and the global deaths caused by them in 2016

S. No.	Major non communicable disease	No. of deaths (in million)	NCD %	Global %
1	Cardiovascular Disease	17.9 million	44%	31%
2	Cancers	9.0 million	22%	16%
3	Chronic Respiratory Disease	3.8 million	9%	7%
4	Diabetes	1.6 million	4%	3%
5	Total	32.3 million	79%	57%

stress-induced cytosolic chaperones transcript and protein levels such as HSP70 and GRP78 were significantly higher in the CR skeletal muscle [86]. This data strongly suggest that CR in humans is associated with an increase in key molecular chaperones and autophagic mediators involved in cellular protein quality control and removal of dysfunctional proteins and organelles. To our knowledge, this is the first set of data showing that long-term CR in humans up-regulates the HSF/HSP pathway and down-regulates the activity of the insulin/IGF pathway, which have been shown to play a key roles in promoting health and longevity in several experimental model organisms [92-94].

The practices of the Prophet are referred to as Sunnah and it serves as one of the sources of Islamic legislation [13]. The Sunnah eating practices taught fourteen centuries ago, by the Prophet Muhammad (PBUH), promote the elements of healthy eating. It has been a beneficial aspect to study as it facilitates reduction of the risk of getting many chronic disease viz diabetes, cardiovascular disease, hyperlipidemia and kidney problems. Moreover, the reduction of the risk of getting such diseases increases the Quality of Life of an individual. The purpose of taking food should be to make oneself strong and healthy for worship. The intention behind eating should not be "live to eat", rather it should be "eat to live". One, who follows the Prophet Muhammad (PBUH) in eating, is the one who eats very little and that is just enough to survive and worship [95].

A follower of Prophet (PBUH) is instructed not to overeat. He should eat some morsels to strengthen his back. One should not eat more until one third of the stomach is filled. It is quite amazing to see that the words of the Prophet (PBUH) predate scientific studies that connect caloric restriction to longevity and better health by 14 centuries. Nevertheless, it has been only recently that a number of research papers are published in large number of medical journals and they have demonstrated that human subjects following calorie-restricted diets show a significant drop in various risk factors including cardiovascular diseases and cancer. The Prophet Muhammad has expressed his greatest fear regarding his followers for the appetites of transgression with regard to the stomach and privates [96].

8. CONCLUSION

The unprecedented change of social and economic nature at the global level has certainly influenced dietary patterns and physical activity. It has led to the improper dieting and unbalanced lifestyle. This imbalance in energy intake than expended at global level has given rise to a major challenge faced by humanity at present. It is the challenge of health problems like obesity, coronary heart disease, hypertension, diabetes, depression, cancers etc. There are more overweight than underweight people in the world due to overeating. Recent research demonstrate that human subjects following calorie-restricted diets show a significant drop in various risk factors including obesity, coronary heart disease, hypertension, diabetes, cancers and increase in longevity. Moreover, the reduction of the risk of getting such diseases increases the quality of life of an individual. The purpose of taking food has to be taken as means to live and not as ends. Taste and quantity of food shouldn't be preferred over control diet in order to avoid sickness.

Beside calorie restriction (CR) is a blessing to be realized as it is the only known nutritional intervention that potentially weakens the effect of aging [97].

A golden reply by Prophet Muhammad (PBUH) to the Persian physician in Madinah, when no patient approached the physician for two years together for treatment and he complained about it, has a remedy for the present global challenge of major NCDs. The reply was: It is the custom of these people not to eat until hunger overcomes them and to ceases eating while there still remains a desire for food. And the physician exclaimed this to be the sole reason for the perfect health of people there [28]. The CR has thus been highly beneficial for human health and the Sunnah of control diet is in line with CR. Adopting it can help us to overcome, avoid or postpone the challenge of various health problems like obesity, coronary heart disease, hypertension, diabetes, depression, cancers etc.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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