Editorial Commentary

Modern human lifestyle prejudices epigenetic changes to cuddle diseases

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Modern science and medicine have increased the human life-span, mostly via decreasing the rate of infectious diseases and child mortality. The apparent result of modern lifestyle has been long-lasting bad-repercussions upon human life through modification of gene expressions via epigenetic changes. These changes are made upon a nucleotide of DNA or on histones, the proteins surrounding the DNA, without altering the genetic sequence. Humans have rapidly acquired several chronic diseases, mainly through the life-style modifications, such as, the sedentary lifestyle, consumption of processed foods and drugs, increased psychological stress, excessive hygiene and through the exposure to environmental toxins, and pesticides in foods (1).

Human DNA is tightly packed to a fundamental unit called nucleosomes. A nucleosome consists of 146 base pairs of DNA wrapped around an octamer of histone proteins (two copies of the histones H2A, H2B, H3 and H4). Methylation of DNA (mostly at the cytosine residue) and the reversible modifications of histones (such as methylation, acetylation, phosphorylation, and ubiquitination) are the important epigenetic inscriptions that can alter the expression levels of genes, resulting in a diseased phenotype. For example, some of these epigenetic modifications can be resulted in a decreased expression of anti-cancer genes, and an increased expression of cancer promoting genes (2).

These altered epigenetic patterns in humans are mainly assimilated by a broad range of environmental factors. And importantly, some of these epigenetic characteristics are transmitted to descendants by heredity. From the preconceptual environment to the birth of the baby, several maternal factors (maternal diet, smoking, mental health and the social environment) can alter the epigenetic profile towards a pathologic phenotype in the offspring. Moreover, the paternal factors (alcohol consumption, and exposure to toxic chemicals such as vinclozolin and chromium chloride) are known to cause a chaotic epigenetic pattern in sperms that lead to trans-generational carcinogenesis (2,3). The type of child birth (caesarian section or vaginal delivery), and the maternal care during the childhood too influences the epigenetic alterations in the growing child. Importantly, in the phase of adulthood, following a healthy lifestyle such as consumption of healthy-diet, regular exercise, maintenance of the normal flora of the human body, and the practice of alternative medicine (ayurveda, yoga, taichi, reiki, acupuncture, body massages, and naturopathy) are known to bring about an improved human health through beneficial environment-epigenome interactions (2). Whereas, exposures to environmental toxins are like heavy metals (arsenic, nickel and cadmium), plastics (Bisphenol A and phthalates), and the usage of drugs of abuse (opiates, amphetamines, alcohol and nicotine) resulted in detrimental epigenetic alterations (4). Factors such as diet, seasonal changes, including the alterations in the sleep pattern, financial status, psychological stress, social interactions, usage of therapeutic drugs, and exposure to electromagnetic radiations from electronic gadgets or diseases might have beneficial or harmful effects depending on the specific nature of the epigenetic modifications (5,6).

Numerous scientific studies have evidenced that the epigenetic maladaptations in humans have resulted in type-2 diabetes mellitus, obesity, and cancers, cardiovascular diseases, autoimmune and neurological disorders like

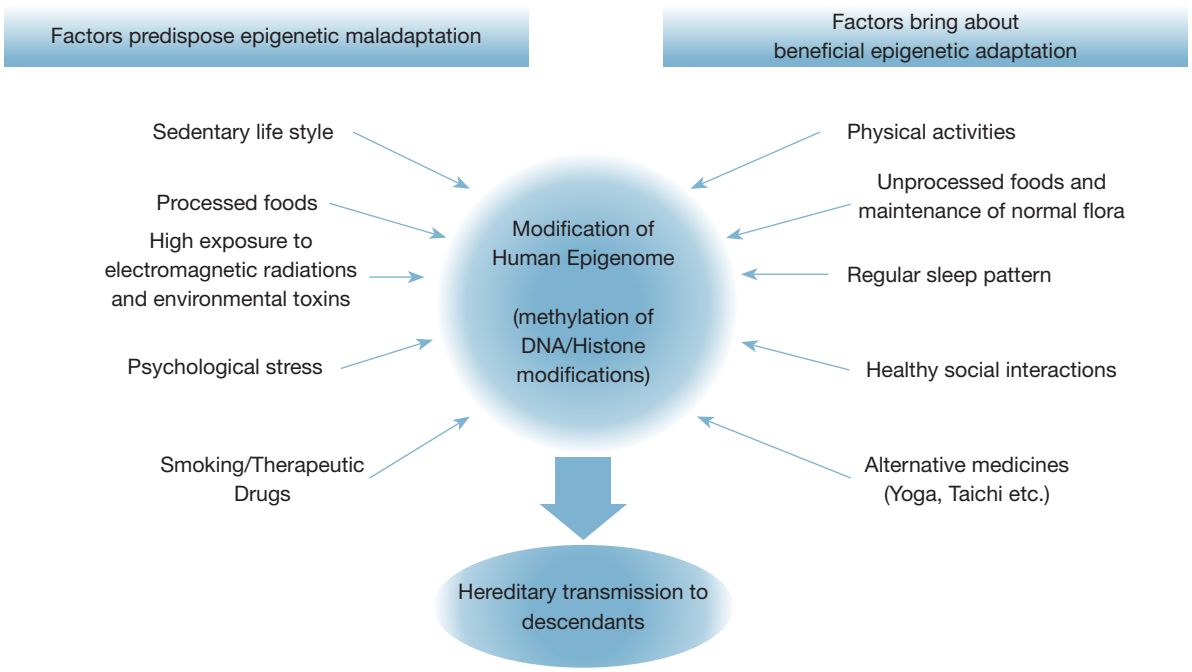

Figure 1 Human lifestyle factors alter the epigenetic characteristics. The sedentary lifestyle, regular consumption of processed foods and drugs, increased psychological stress, and the exposure to environmental toxins has a great negative impact on the modification of epigenetic characteristics, such as methylation of DNA and or several modifications at histones. Periodic physical activities, consumption of unprocessed foods like raw vegetables and fruits, maintenance of the normal flora of the human body, and the practice of alternative medicine can bring about an improved human health through beneficial environment-epigenome interactions. These epigenetic changes are transmitted to descendants by heredity.

Huntington, Alzheimer, Parkinson and schizophrenia (7,8). The following two clinical studies (9,10) explain the importance of life-style modifications, and its implications on epigenetic modifications.

(I) The variations in the lifestyles and habitats on two different African population groups (the active rainforest hunter-gatherers and the sedentary farmers), whose ancestors diverged about 60,000 years ago, had a critical impact on their patterns of DNA methylation variation, resulted in different biological functions, especially on the immune mechanism. This study indicates that the urbanization likely has an influence on the development of autoimmune disorders (9).

(II) On the other hand, an increased physical activity alone had a favorable impact on the survival outcomes of breast cancer patients, through epigenetic regulation of tumor suppressor genes (10).

Hence, it is time to realize that, our current lifestyle will influence the health of our inheritors. Although in our 'modern' environment, we cannot completely avoid the exposure to electromagnetic radiations, air pollution, and foods contaminated with chemical pesticides. It is an immediate need to adapt a healthy lifestyle, such as increased physical activities (preferably, without using machines), regular sleep pattern, healthy social interactions, a reduced screen time with electronic gadgets, regular consumption of unprocessed foods, such as raw vegetables, fruits, nuts. At the same time, one must avoid processed foods, and the exposure to toxic materials like plastics (*Figure 1*). Furthermore, to maintain a good epigenetic trait, and to preserve our human descendants, we should strictly follow the rational usage of therapeutic drugs, and avoid the irrational use of antibiotics to maintain the beneficial human microbiome in our body. Since the epigenetic changes are transmitted to descendants by heredity, it is time for us to realize and adapt a 'natural-way' of lifestyle, rather than a 'modern' lifestyle to maintain a healthy epigenetic environment, and to preserve our human descendants. Future, more retrospective and prospective

studies are needed to examine the safe lifestyle and the healthy epigenetic changes that are contributing in human population.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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