



## On the Possible Influences of Climate Change and Global Warming on the Changing Nature of Human Physique and Psyche

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### Abstract

The nature of human physique and psyche are changed by different autogenic and environmental factors. One of these the most gradually effective factors are climate change and global warming. One of the major impacts of climate change and global warming on human intrinsic and extrinsic characteristics are revealed by this study which is basically fulfill the objectives to reduce or minimize the physical and psychological health related decline of man, social degradation caused by psycho-pathological decays and to understand how the gradual climate change and global warming effect on human anatomy, morphology, physiology and human mind which is ultimately become a cause of some change in human body and abstract feelings. It may be pointed that the process of living is characterized by stresses those may be fund in human's external environment and for those purpose the adaptation of human body and mind is occurred to maintain the optimal equilibrium. The study has been made by mainly secondary data and descriptive statistics to understand the possible influences of climate change and global warming on human physique and psyche. The results show that Human brain have shrunk over the past 20,000 years the average size of modern human brain has decreased from 1500 to 1350 cubic centimeters. Moreover, global warming will cause 180,000 cases of rape in the United States of America and stress related disorders, obsessive-compulsive disorders and post-traumatic stress disorder are also partly affected by climate change. These are the glimpse of the evidences of the influences of climate change and global warming on human physique and psyche. In the present study the empirical and generalized view of those impacts are represented which ultimately show that humans' adaptive nature is also changed in the new evolutionary era of global warming. The study concludes with further researches and some suggestions of preventive measures about the influences of climate change and global warming on human physique and psyche.

**Keywords:** *Climate change, Impact on physique, Impact on psyche, Behaviour and adaptation, Suggestive measures*

### 1. Introduction

Climate change and global warming is none of the important issues of present century. Inter-governmental panel on climate change (IPCC, 2007) [1] in their 4<sup>th</sup> Assessment Report (AR4) disclosed-“The earth temperature has increased by 0.74° c between 9906 (BC) - 2005 (AD) due to increase in atmospheric emission of greenhouse gases (GHs).” IPCC also stated that at present the total amount of earth's increasing temperature caused by human activities is 90-95 %, which is called ‘Global Warming’ and 5-10% are created by ‘Climatic Variability’ for non-human caused variations. It is said that climate change is any ‘long term’ significant change in the ‘average weather’ that the earth experience, where the global warming is ‘short term’ change. The earth's atmospheric increasing temperature caused by mainly anthropogenic activities ultimately sprays the reversal effects on human physical and psychological structures and functions in this modern era throughout the world. The report published in ‘The Gurdian’ by Wainwright, 2007 [2] where Simon Mays (the human skeletal Biologist in change of the Evolutionary Historical Study) told that “there is also a puzzle of why male skull shapes eventually reverted back, becoming similar to those we have

today...but the climate at Wharram during the critical period rose by 0.5°C and was actually warmer than it is today. Further as the weather got much colder in the later medieval period skulls started to become larger and narrow again.” “Much research has established that uncomfortably warm temperature can increase the likelihood of physical aggression and violence (Anderson, Anderson, Dorr, DeNeve and Flanagan, 2000) [3].” “In this state now a day’s ‘human system’ can adapt with this situation by keeping up the exact rate of responses of climate related stimuli in human physique and psyche with the variation of ‘levels of impact’ (Parry, 1886) [4].

The previous literatures indicates the possible influences of global warming and climate change on human adaptive nature which is also gradually affect human psyche. Thus, human physiological stimulants have been changed abruptly and have resulted a reverse effect on human health. Moreover human psychological condition has been changed due to the increasing condition of weather components in an unnatural way which results vulnerable effects on the familiar, social and other relationships. In this purpose the present study highlights some empirical and literally evidences about the possible influences of climate change and global warming on humans’ physique and psyche. The relevance of the study is that the study emphasizes a general overview on the possible influences of climate change and global warming on humans’ physique and psyche on the basis of some significant evidences which helps to understand how the rapidly changing climate effects on the humans’ body and mind and how those are gradually changes a new era of evolutionary stage.

## **2. Objectives**

1. Highlight the changing nature of human brain, skull and body shape with relation to changing climate and global warming.
2. To formulate the changing nature of human psyche affected by climate change and global warming.
3. To state about psychological response, social behaviour and adaptive nature of human towards climate change.
4. Suggest some mitigation measures on the influence of climate change and global warming on human physique and psyche.

## **3. Database and Methodology**

The present study has been done mainly by secondary databases and e-literatures which are used to fulfill the mentioned objectives to formulate the influence of climate change and global warming on human physique and psyche. The various databases are collected from the different e-literatures and represented by Microsoft Excel (2013). Moreover, the different reviews about the influence of climate change and global warming on human body and mind are highlighted through citing various literatures collected from the e-sources in the present paper.

## **4. Results and Discussion**

### *4.1 Impact of climate change and global warming on human physique*

Human physical condition means its biological morphological, anatomical and physiological development during the prehistorically evolutionary phase of human. The physique of human is changed affected by the natural environment and it is basically related to the changing nature of climate. From the very beginning of human’s evolutionary stage till now, the changing climate caused by natural factors which is literally called global warming deeply and negatively effect on human body, mainly on its morphological condition, anatomical structure and physiological conditions.

#### 4.1.1 Changing nature of human brain, skull and body shape with relation to changing climate and global warming

The studies of paleontologists and palaeo-climatologists and other evolutionary biologists indicate that environmental condition with changing climate may have stimulated important developments in human origins and emergence of diverse species with suitable adaptations which have accumulated over time, including upright walking, the capacity to make tools, enlargement of complex mental and social behaviour and dependence on technology to alter the surroundings. The period of human evolution has coincided with environment with climate change, including cooling, drying and wider climate fluctuations over time. It also effects on human skull size, brain volume and body shape development with the adaptation and extinction of *Homo sapiens sapiens*. Such example is the changing condition of Neanderthal body structure and function and its extinction accrued at Pleistocene at the time of second ice age.

The human skull is a body structure, the head in the skeleton, which supports the structure of the face and forms a cavity for the brain. The evolutionary history of human (*Homo sapiens sapiens*) indicates the impact of gradual climate change and earth's atmospheric warming on the basic structure of human anatomy like as human skull. The report published in 'The Gurdian' by Wainwright, 2007 where Simon Mays (the human skeletal Biologist in charge of the Evolutionary Historical Study) told about the puzzling situation of the impact of increasing and decreasing temperature on the changing situation of male human skull shape in Wharram in respect of medieval period and present situation.

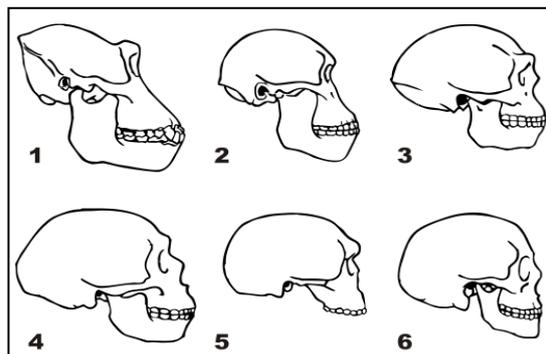


Figure 1. Skulls of: 1. Gorilla, 2. Australopithecus, 3. *Homo erectus*, 4. Neanderthal (*La Chapelle aux Saints*), 5. Steinheim skull, 6. Modern *Homo sapiens*

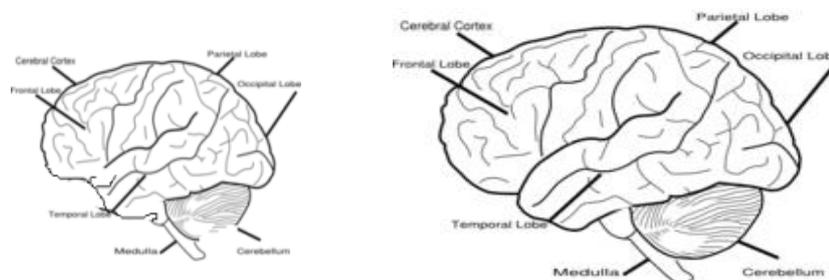


Figure 2. Endocasts of *Homo erectus* (left) and *Homo sapiens* (right) illustrate rapid increase in brain size

Sherriff published a report in 2007 in 'The Register' that "the researches (University of Albany, New York) concluded that the humans got brainer because they can adapt with changing environment. The base of this assertion is that on a plot of cranial capacity of 109 fossilized human skulls against the corresponding paleontological record of two million years of changing climate." The estimated relationship between a changing condition of earth's climate and human skull size is revealed by this research which suggests that the adaptation in lower temperature with changing climate the skull size may increase 50% to their original size. This also becomes clear that the variation in seasonal temperature may also be an important selective force behind the evolution of human cranial capacity.

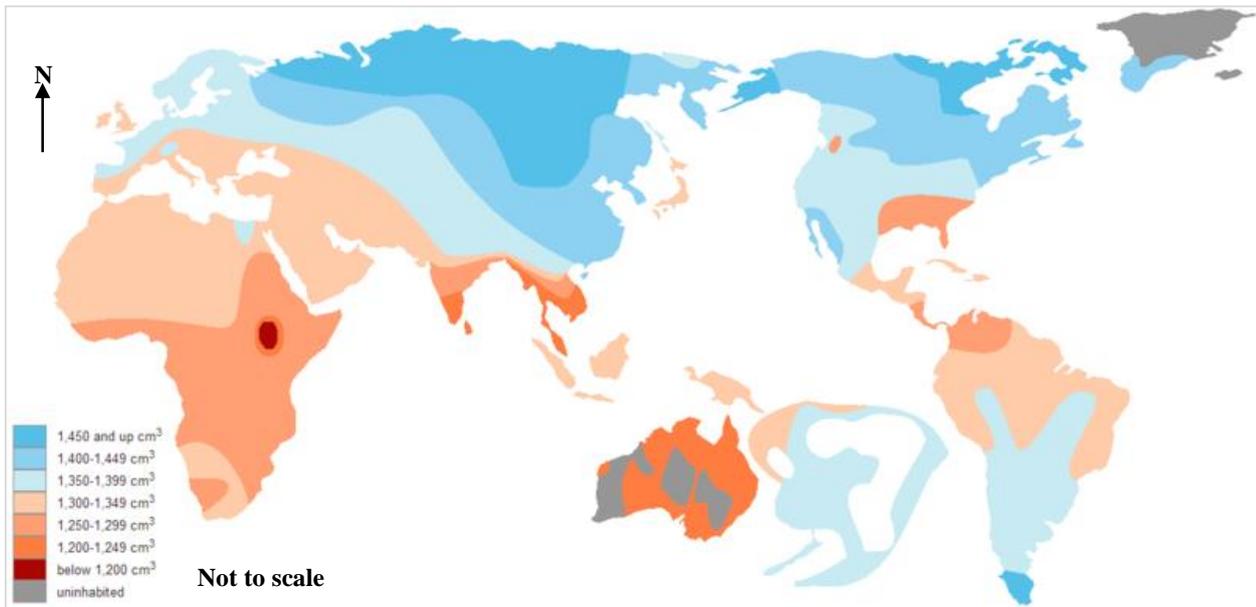


Figure 3. Variations in cranial capacity in humans' brain size over the world (Source:Beals, Smith and Dodd, 1984)

Human brain have shrunk over the past 20,000 years the average size of modern human brain has decreased from 1500 to 1350 cubic centimeters (Daily Mail Reporter. 2010). The brain size and cranial capacity of the modern human in the human evolutionary route indicate Homo sapiens in the early stage contains 1330 cubic centimeters brain volume, but it is now decreasing.

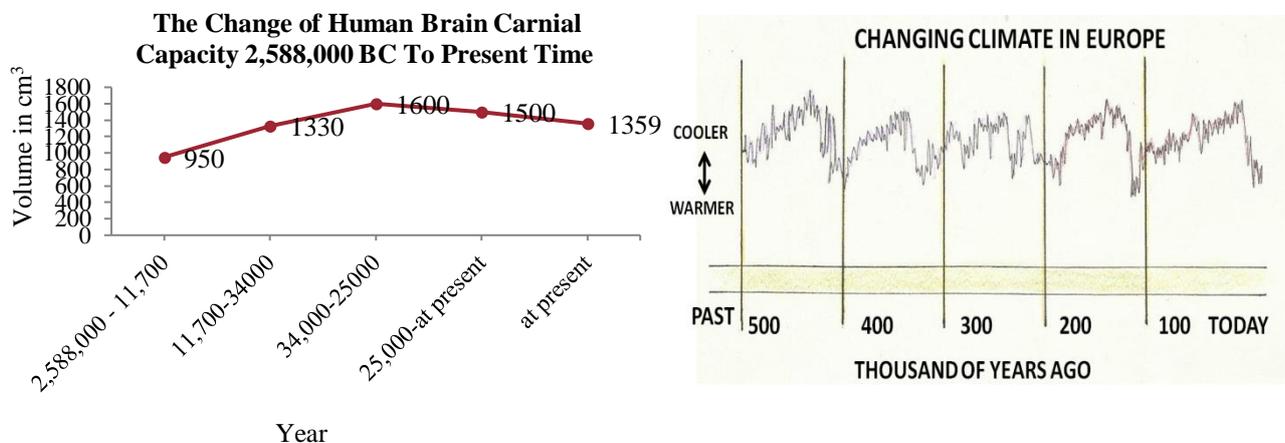


Figure 4.Changes of cranial capacity of human brain, Figure 5. Changing climatic situation in Europe (Smithsonian National Museum of Natural History, 2018)

The recent global warming is one of the major causes of this type of decreasing as it impacts on gradual evolution of human species. The climate change may have spurred human evolution by facing to a rapidly situation of change. Thus the abrupt change of human physical conditions may be occurred or created. The gradual changes of brain volume of human from *Homo habilis* to *Homo sapiens* are affected by the gradual climate change in the evolutionary track from Pleistocene to Holocene period. The changing trend of human brain volume is represented in the fig. 4.



The skeleton of a *Homo erectus* in East Africa about 5 feet 3 inch. The research shows that this species might have grown nearly 6 feet. His tall, lean body was well adapted with changing and dry climate. (Smithsonian National Museum of Natural History, 2014) Moreover 40,000 years ago the average height of European male was 6 feet, and 10,000 ago this average height was reduced to 5 feet 4 inch affected by climate change. This indicates the regional variation of the impact of climate change and global warming on human physique in the evolutionary way of human in the earth. More researches indicate that most of the diseases occurred in the last 6,000 years.

*Figure 6. The skeleton of a Homo erectus found in East Africa (Source: Smithsonian National Museum of Natural History, 2018)*

The researches on human evolution affected by changing climate indicates that the bulky bodies are better at conserving heat, larger frames may have fared better in the colder climate. With the warming condition of planet, natural selection might have forced people of slighter stature. So, skeletons and skulls shrank as the temperature rouse and the brain got smaller in the process in a warming trend in the earth now a days with comparing to warming periods occurred many times over the previous million years, yet body and brain size regularly increased.

Physiological responses with climate change and global warming: many physiological changes and pathological changes including diseases may be caused by gradual climate change and warming of earth's atmospheric temperature. Human body responds to changing climate mainly in the hot and cold climate. Thermoregulation is increased now a days as warm blooded animals also rely on physiological mechanisms which can produce or dissipate heat. Some pathogenic condition and diseases may also be increased influenced by climate change and global warming such as 'climate change induced diseases'-cardovascular, panchriatic, oral, ovarial, renal, seribral, vector borne, infectious and pollution induced diseases as such which ultimately tends human to a new challenge and also a complex biological adaptation with changing condition of climate.

#### *4.2 The changing nature of human psyche affected by climate change and global warming*

Human mind is a set of cognitive features that enables consciousness, perception, thinking, judgment and memory. The changing condition of human mind depends on the body-brain co relation which is situated with the biological substrates of behaviour and mental processes which changes with the change of its surrounded environments mainly temperature and its change which is related to the warming of earth's atmosphere or it is called global warming. With the change of earth's atmospheric temperature the normal condition of brain may change. The function and structure of brain is depended on origin or creation of hormones, enzymes or the activity of neurons. The circulatory system of brain which circulates the hormones and enzymes throughout the brain controls the behaviour and others mental condition of 'homoeothermic' human and also the signals which the brain takes from the body, that response of signals may be changed due to gradual warming of atmosphere. Such the nature of human mind depends on this relative processes as follows:

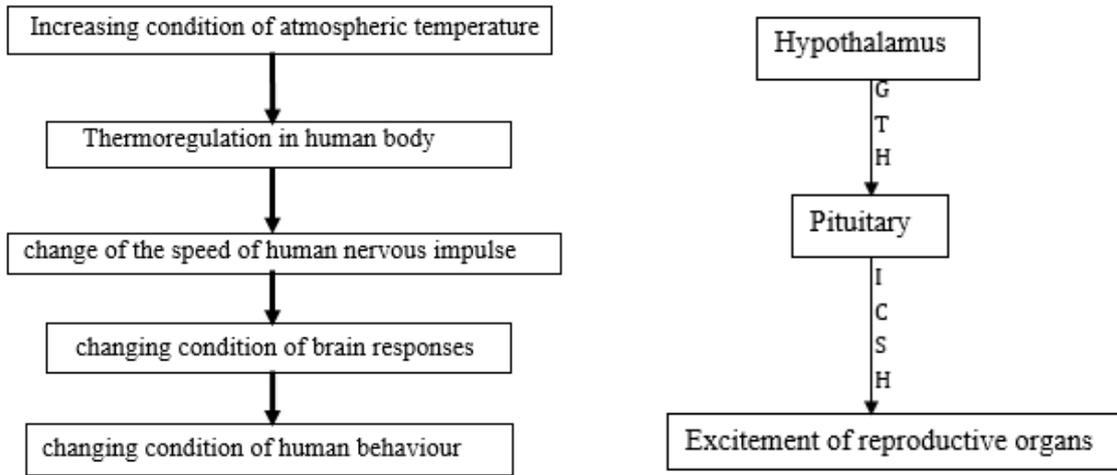
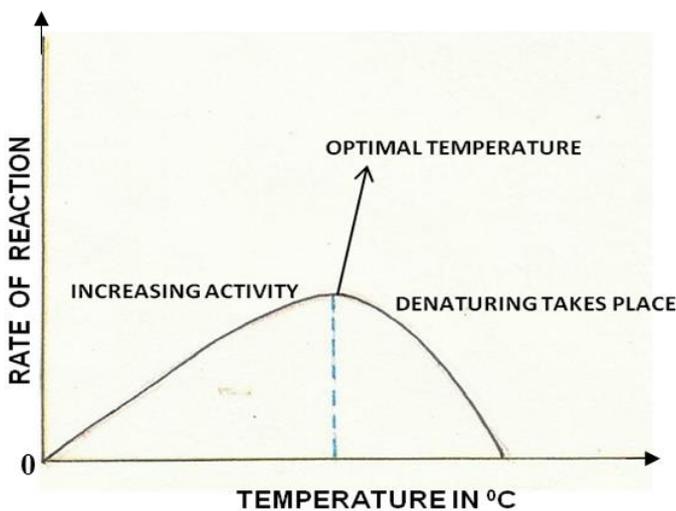


Figure 7. Relationship between human response and thermoregulation, Figure 8. Role of Pituitary on responsive behavior

Climate change and global warming, increasing temperature creates an uncomfortable situation in our body and brain or mind and hot temperament arises due to this condition. Moreover in extreme cold the body responses become low and relatively human mind and behaviour responses in low frequency. The increasing earth's atmospheric temperature from the age of industrial revolution increases the mental diseases and behavioural change in our mind. The seasonal change of temperature and the arrival of a particular season become too late in India which is basically the region of monsoon climate .in this situation the adaptive nature in our body changes abruptly and thus the mind responses in a negative way and the behavioural change like hot temperament and aggression, worry, anxiety, depression, obsession etc. are increased. In increasing rate of temperature, the rate of GTH (Gonadotrophic hormone) is increased and thus human become more sexually excited.



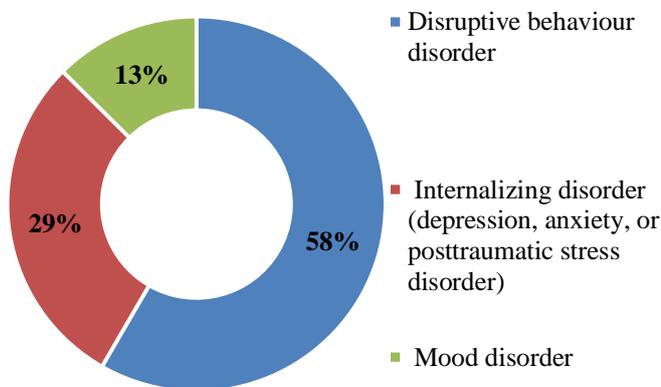
The recent study by Ranson (2014) states that global warming will cause 180,000 cases of rapes in the US. The paper estimates the impact of climate change on the criminal activity in the United States. The analysis is based on a 30 year panel of monthly crime and weather data for state-by-month and country-by-year fixed effects.

Figure 9. Enzyme responses in changing temperature condition (Source: Nelson and Cox, 2005)

The results indicate that temperature change impacts strongly on criminal behaviour. For example the report shows that between 2010 and 2099, climate change will cause an additional 22,000 murders, 180,000 cases of rape, 1.2 million aggravated assaults, 2.3 million simple assaults, 260,000 robberies, 1.3 million burglaries, 2.2 million cases of larceny, and 580,000 cases of vehicle theft in the United States (Ranson, 2014). The other extrinsic behaviours are changed due to temperature increase. For example, the changing nature of Adrenaline and Noradrenaline effects on the changing condition of some emotion which triggers part of the 'fight of flight' brain responses. The recent field experiment by Vrij, Van der Steen, and

Koppelaar (1994) opines that Dutch police officers were more aggressive and reported threatening impressions of the suspects. Moreover, the changing condition of ‘Testosterone’ in human body effects on the increasing nature of human aggression. “Much research has established that uncomfortably warm temperatures can increase the likelihood of physical aggression and violence (Anderson and Anderson, 1998: Anderson, Anderson, Dorr, deNeve and Flanagan, 2000).”It is noted that “If average annual temperature in the United States increases by 8 F (4.4 C), the best estimate of the effect on the total murder and assault rate is an increase of about 34 per 10,000people, or over 10, 0000 more such serious and deadly assaults per year in a population of 305 million”(Forgaset al., 2011).

**The rate of three types of mental disorders among the children of age six and younger in United States of America (During the period-2009 through 2011)**



Mental health disorders are broadly related to mild disorders, such as social phobias and fear of speaking in public, depression and suicidal ideation, evendeadth. recent study have regarded as stress related disorders, obsessive-compulsive disorders and post-traumatic stress disorder are partly affected by climate change, which is regarded as the evidences of global warming at present situation. An estimation of 58% of selected Americans over the children of age six and younger have suffered from the disruptive behavior disorder, 29% have suffered from internalizing disorder and 13% have suffered from mood disorder during the period-2009 through 2011. (Magellan Healthcare, 2017)

*Figure 10.Types and rates of mental disordersin U.S.A.*

Psychological impacts of climate change is transformed from mild stress response to chronic- stress response. A variety of psychological impacts can be associated with extreme weather and other climate change related natural calamities.Extreme weather catastrophic conditions such as Hurricanes, wildfires, flooding can create increased anxiety and emotional stress about future. The increasing rate of natural disasters due to resent climate change and global warming can destroy several lives, damage of property, and injury of beloved, geographic displacement which create mental health or stress related problems.

Impact of climate change and global warming on children’s body and mind are most effective and harmful. The recentstudies on India represent that the climate change increases the frequency and intensity of heat waves, by which rates of death and serious illness rises, particularly by children (0-6 years). Affected by natural disasters and others climate change related phenomena on children mental condition such as child Post-traumatic disorders (PTs), which was biometrically experimented and evaluated after an abrupt super-cyclonic condition in Orissa state in India. Moreover for an example Tsunami in Thailand in December, 2001 left nearly 60% of the children with PTS (Post-traumatic stress) at six weeks after the incident.

*4.2.1 Neurological disorders and climate change with changing human behaviour and adaptation to climate /environment*

Study of Neurobiology and Medical Psychology reveal that human genetic condition, mainly behavioural genes are changed due to the adverse effect of climate. The changing conditions of genes

effect on human neurological condition and behaviour. If the temperature increases rapidly and the climate changes gradually the environmental risks and an unknown number of pathogens will increase dramatically. The pathogenic environment influenced by global warming will influence to increase the behavioural, genetic and neuropsychological risks within individuals with interaction to neuropsychological behaviour with genes to predict antisocial behaviour. For example, Beaver, DeLisi, Vaughn and Wright (2008) found that “Neuropsychological deficits, such as those implicated by prenatal nutritional deficiency, interacts with the low-activity polymorphism in the ‘MAOA’ (Monoamine oxidase A gene) gene to predict violence behaviour, delinquency, and low self-control across two time periods.” With these the medical study of human body brain ‘thermoregulation’ also opines that the tropospheric temperature change can effect on human neurological condition and behaviour. Moreover the hypothermia due to atmospheric warming effects on human brain, thinking power, increases temperament and violence.

The United States has seen an increasing trend in the prevalence of neurological diseases and deficits such as Alzheimer Disease (AD) and Parkinson Disease (PD) are occurring at earlier ages, healthcare stresses, and there are indicators that environmental factors may be involved including changes in climate that may exacerbate factors affecting the rates and severity of Neurological conditions.

#### *4.2.2 Psychological response of human to climate change*

Cognitive analysis assesses the knowledge base and awareness level of respondents about various dimensions of climate change. Presentation by Pawlik (1991) is referred to this as the ‘low signal to noise ratio of global change’. As presented above, evidences show that the global mean temperature has raised approximately 0.74°C and is going to increase between 1.1 to 6.4°C over the next 100 years. However, the variation in temperatures that human body normally experiences from summer to winter, the changes and the physical signals become weak due to climate change. Thus the sensory and memory mechanisms are unable to discern them as they are below the common threshold of discern ability.

As a hidden hazard climate change tends human to increase psychological barriers which resulted as social barriers to human and thus judgment barriers occur due to ignorance about climate change with cognitive short-cuts.

#### *4.2.3 Social behaviour and adaptive nature*

Regarding these above discussion it is said that social and community impacts of climate change is revealed through the increase of disharmonic social distance and social dilemma. For example, so many governmental and scientific reports and studies note that the climate change has increased existing tensions and social conflicts observed in the Darfur region of Sudan and in Bangladesh. (Forgaset al., 2011)

In this state now a day’s ‘human system’ can adapt with this situation by keeping up the exact rate of responses of climate related stimuli in human physique and psyche with the variation of ‘levels of impact’ (Parry, 1986).

#### *4.3 Suggestive measures*

Suggestive measures are needed to human to adapt with changing climate and face to the challenges of global warming, such as:

1. Reducing of emission of more greenhouse gases can decrease the increasing rate of global warming.

2. Expanding research on the toxicity of chemicals known or suspected to cause adaptive change of Human physique.
3. Improving our understanding of the impact of increased heavy precipitation, ice melts, and flooding events on the risk of environmental contamination through storage-related issues or runoff, focusing on the likelihood of the event, the geographical areas and populations likely to be impacted.
4. It is also needed to reduce the level of environmental pathogens which affect adversely on human body and mind by sustainable use of science and technology.
5. As climate change is mainly a physical phenomenon which trend is increased by anthropogenic activities in this present century, so, the people may conscious to interact with earth's environment.
6. Examining the neurological health benefits and costs of new climate change mitigation technologies, including research on the toxicity of new metals and metal compounds, including nanotechnologies.
7. As there is some limited evidence that the heat-aggression effect on individuals, more research is needed and it can be reduced by simply making people aware, Government participation and educational interventions.

In 2009, the World Health Assembly endorsed a new WHO work plan on climate change and health. This includes Advocacy, Partnership, Science and evidence and health system threatening.

## **5. Conclusion**

The overall trend of the possible influences of climate change and global warming indicates the adverse effect on human physique and psyche. Developed and developing countries will be affected differently by climate change and global warming in this aspect. The nature of human physique and the neurological as well as psychological conditions of them are gradually changed by the effects of rapid climate change. The cranial capacity of human brain is changed from the past to present in the variability of climatic effectiveness. Presently, the crime rates are also be affected in various way by the increasing temperature conditions. In this situation human adaptive nature is also changed in the era of global warming. Thus it is concluded with the optimum goal to reduce the adverse impact of climate change and global warming on human physique and psyche with more individual, national and international cooperation to keep up the true balance of human evolution and social response with changing climate to stop failure to do so, which will result in additional disasters for millions of people. Further researches would be conducted with more emphasizing on the primary level survey and higher statistical and scientifically experimental evidences to find out the specific impacts of climate change and global warming on human physique and psyche.

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## **Competing Interests**

The author declared that there is no competing interests exist in the present study.

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