INTRODUCTION

One of the stalwarts of Gerontology and Geriatrics of our times, Dr. Edward G. Lakatta [1], in his McDonald lecture “Artery 12,” delivered at Vienna, Austria, on October 20, 2012 stated that “Any discussion about any aspect of aging cannot beg the issue of what aging is. It is a tough question, and there are numerous perspectives regarding the answer. My view is that “aging is a shift in organism’s reality.”, and adding to that he states that- “reality can be defined as a system of mutual enslavement of DNA and its environment.”

Boron [2] has mentioned that generally agreed on panel of biomarkers has yet to emerge, so currently it is impossible to quantitate aging. As a rule, aging of human beings is a universal phenomenon.

Entities of animal kingdom, plant kingdom or even inanimate articles have aging and associated diminished strength [like civil engineering monuments or building structures.]

From time immemorial, the sages, seers or scientists; of occidental or oriental world, with open mind inquest, have been intrigued and impressed by the epochs of aging- a down-hill course in biology of man.

To enhance health, retard physical disorders, pursue life of long expectancy, minimizing limitation and add a positive sense of bliss were perhaps the probable goals of these researchers across millennia in past and the same still persist as an unending aspiration.

Western historians state that Alcmeon of Crotona (500 B.C.) was the first who presented views about functions of Soma - (Body).

Keswani has also mentioned various historical periods and their chronology, in connection to Vedic and Post Vedic Periods.

At home or abroad, during this long spectrum of history, man has expressed curiosity and inquest for aging changes and solutions to disorders related to it.

In the treatise on “Rasa Vidya” Shrimat Govind Bhagvatpada[4] in his book “Ras Hridaya Tantra”[? 7th Century] has mentioned about longevity and medical compounds useful for it; but this book in its unabridged form and explicit details for the various synonyms for medical plants used; is not available.

In early pages of this treatise; Sir P.C.Roy while commenting on the text and giving history of Chemistry mentioned that “even in Rigvedic time, some substance called “SOMA RASA” [equivalent to Greek “Ambrosia”, [he mentions,] which was claimed to give immortality, was there.

It is noteworthy that Adi Shanker [5][whose time is disputable,] gave a very vivid account of aging person- having sarco penia, fraility, edentulous wrinkled face, grey hair, who walks with help of a stick [“IADL” - Instrument Assisted Daily Living ?] and the reverend author has also declared that “indeed, time eats away the world!”
The history of Gautama Buddha, [whose denouncement was consequent to seeing an aged person with curiosity]; the centenarian life of “Father of Modern Medicine” Hippocrates, while in his time, life expectancy was only around 30 years. - are a few of shining examples of quest and successful management of aging in past centuries.

In the contemporary literature on Yoga, a number of yogis like Maha Avatar Baba [6] Trailang Swami [7] Yogi of Gyan Ganj [8] and Devraha Baba who was visited by Pt. Nehru and the then President Dr. Rajendra Prasad; is speculated to have life span of rather more than 200 years!

S.K.Manchanda et al. [9], in his article “Yoga and Scientist” state that- “recently many scientists of unquestionable integrity have published reports to authenticate existence of these psychic phenomena. Many laboratories in the U.S.A. Europe and the U.S.S.R. are vigorously perusing research in this field…if a practitioner can successfully channel this serpent power [Kundalini Shakti] through the successive steps, of the various nerve centers [Chakras], he is able not only to control his autonomic activities and sensory inputs but also acquire skills and powers of mind which are supernormal or paranormal.” The reason for bringing the point of such incredible longevity in foreplay, is that, these exceptional looking examples may be of those individuals who could gain the healthful existence in aging period by perhaps defying the usual and inevitable phenomenon of Homeostenosis which ends fatally during the downhill course of life due to its progressive increase in aging of common man. It is possible that some clue lies in their way of life which displays retarded state of Homeostenosis. This may be treated further in chapter of discussion.
Such vertical achievement can so occur as an exception to a law but may not be a generality for most human beings and for them, hence aging is an unpreventable, progressive downhill course of many biologically important phenomena which leads to gradual yet progressive state of loss of functional reserves—called “HOMEOSTENOSIS”.

With added medical progress and care, the decrease in child death and increase in life expectancy has raised the number or percentage of aging population. Therefore, the study and management of issue of homeostenosis is the need of this large population, and need of the time.

The line of difference between “physiological aging” and “pathological homeostenosis” is often vaguely distinguishable and hence the aging of each person may be outcome of individual phenomenon affected by various intrinsic and extrinsic mechanisms and the response may be variable to some degree and manner.

Indians had average life expectancy of 26 years at time of year of Independence [1947], to presently [in year 2015] of 64 years, also it is stated by Harsh Mohan [10] that, survival is longer [3:2] in females as compared to males. Listing organ changes in aging the same author has mentioned about cardiovascular decline in morphology and function. It is also noteworthy that, G.K. Bhattacharya [11] has given definition, contributing factors, indicator of declining cell function associated with cell aging, alterations in cells aging, and given theories of cell aging in brief.

Best And Taylor[12] have mentioned that, “with advancing age, significant reduction occurs in functional capacities of many different organ systems…often times these changes are secondary to alterations in circulation, which results in impairment of blood flow to specific organ or tissue, which are independent of arteriosclerosis, and
their prevalence increases in elderly. This functional reduction plays important role in cumulative functional impairment.”


Oeppen and Vaupel [14] are of opinion that due to improvement in hygiene and health care, human life expectancy has been increased at the rate of about 2.5 years per decade since the middle of nineteenth century.

According to UN [15] population of aged is 9 % (6.7% in less developed countries and 15 % in developed countries). It has been projected [16] that, by year 2050, the number of elderly people would rise to about 324 millions! The authors have given various statistical values of aging in developed country like U.S.

AH Suryakantha [17] states that, population percentage of elderly is more in developed countries, but the majority of old people live in developing countries.

As such the issue of aging must get the deserving priority in developing countries like India, and there is dire need to focus on the aging population, their aging realities, particularly more on diminishing functional reserves called “Homeostenosis,” in trilogy of Hematological tissues, Respiratory system and Cardio-vascular system.; because, Cyril et al.[18] have stated that, after retirement at 65, elderly people become more liable to infection of respiratory tract, cardio-vascular disorders and malignant diseases. As such the degree of homeostenosis is directly or indirectly responsible for morbidity and mortality in this huge population. The gravity of Indian scenario may be clear by this statement of Kumar V [19]that,” from
morbidity point of view, almost 50% of Indian elderly have chronic diseases and 5% have immobility!"

The senior citizens are age specific elderly of both sexes who may be prone to individual negative physical, socio-psychological, and environment-related risk factors during their aging, capable of causing reduction in the reserves of their vital organ functions leading to “Homeostenosis.”

Hence the candidate was interested in study of homeostenosis in the three closely related system complexes which are interrelated as well as interdependent too, in population of elderly (senior citizens) of Vadodara city.

Vadodara is a rapidly developing and urbanizing city in central Gujarat, with fast rate of growth and progress. It is one of first 10 cities proposed as smart cities by Govt. of India, and has also been designated as one of the cleanest cities of India.

In Vadodara, the population of senior citizens is relatively more as it is conventionally deemed suitable for retired persons. The culture, peaceful ambience, gardens, items and avenues of relaxation and recreation, numerous active organizations related to elderly people and above all reasonably priced excellent quality health care facilities, might be perhaps the reason for relatively denser agglomeration of this population in Vadodara city.

The candidate came to know from personal communication with one expert, that, even the reference values related to Indians for many parameters are yet not available and we have to use the standardized international reference values in many instances. CW Tsang et al. [20] have stated that unavailability of established reference values may create serious issues. They by quoting Soldberg HE, [21] say that the
reference values for elderly may differ from those of younger persons; Tsang et al. have also made clear that inappropriate reference values may increase the risk of either unnecessary additional investigation or, failure to detect underlying disorder. Faulkner WR, [22] states that, deriving reference values is problematic in elderly, because age related physiologic changes are also known to occur.

The study of presence and magnitude of homeostenosis is so far not done elaborately in this elderly group of population of Vadodara city

**Common Eugeric Changes Occurring In “Physiologic Aging”:**

By the term “Eugeric” we mean occurring in normal or physiologic or uncomplicated aging. [Here, additional co-morbid other pathological condition is absent to begin with.]

These changes are vividly described in medical literature often at length by excellent studies done at American Heart Association, Baltimore Longitudinal Study Of Aging, Framingham Heart Study, National Heart, Lung And Blood Institute-USA, and also in many institutions elsewhere in U.S.and also in European countries and Australia.

**Prominent Age Related Changes:**

- Decreased bone marrow cellularity, with decrease in red bone marrow.
- Diminished total body weight with more reduction in fluids [total body water]
- Progressive disappearance of estrogen activity by their increased urinary excretion.[menopause-52 years]
• The Decrease in renal function at the rate of 10 % decrease in no. of glomeruli and nephron function.

• Due to sarcopenia decrease in muscle mass, which is regarded as secondary to diminished muscular action, or loss of neurons related to muscle power or strength and eventually leading to diminished B.M.R.; also decrease in protein absorption.

• Presbyopia [40-45 years onwards] and a number of ocular disturbances are noted. And Presbyacusis [in about 33 % by 75 years]; may be primarily due to degenerative changes in olfactory apparatus. which lead to progressive rise in olfactory threshold and impaired olfaction. tactile sensitivity may become less.

• Senile dementia; decrease in REM sleep time, and stage IV sleep time; slow voluntary movements; tremors, electro encephalogram changes as the processing of afferent signals is redundant, the reaction time and hypokinesia may result.

• Decrease in Cardiac Index; Cardiac Out Put, changes in Systolic Blood Pressure and Diastolic Blood Pressure values; Heart Rate, Pulse Wave Velocity related issues, and Electro Cardiogram features may be abnormal. Changes in vascular aspects, which influence the cardiovascular function.

• Pulmonary functions gradually and progressively deteriorate; may lead to COPD [Chronic Obstructive Pulmonary Disorder/disease] or restrictive pulmonary disease. Numerous changes occur in chest wall like- stiffness, kypho- scoliosis and alterations in lung’s structural components, quantitative /qualitative/or dimensional changes in broncho-alveolar apparatus are presented convincingly.
Changes associated with epithelia, glandular tissues, muscles, cartilages, secretions, molecular mechanisms, capacity and volume of respiration, exchange of respiratory gases, mode of diffusion of respiratory gases, pulmonary vasculature have been mentioned.

Diminished local and general immunity and also non respiratory functions of lung are affected in aging.

- In fact, this is a suggestive list only. And few changes relevant to our population of Vadodara’s Senior Citizens shall be presented in this work in later pages.

Boron[23] states- a generally agreed panel on bio markers of aging has yet to emerge; so currently it is impossible to quantify aging of an individual.

Boron also mentions that, Gompertzian and related analysis has been viewed as “Gold Standard” for population aging which are outcome of report of Gompertz-a British actuary, on age specific death rate.

Now, most evolutionary biologists do not accept that aging is an evolutionary adaptation with genetic program.

It would be worthwhile to briefly present selected theories of aging. Which give insight into what causes may play crucial role in critical changes.
Commonly Presented Theories Of Human Aging:

- Gompertzian theory [Gold Standard Theory as stated above]

- Programmed aging theory. [Weissman-1899].

- Resting metabolic theory,[Rubner-1908]

- Rate of life theory,[Pearl-1928]

- Rate of life theory,[Sohal-1986]

- Theory of mutation accumulation,[Medawar-1952]

- Oxidative damage theory,[Emanual-1952]

- Theory of antagonistic pleotrophy,[Williams-1957]

- Telomere theory, [ Hay Flick and Moorehead,[1961]

- Telomere theory, [Calvin Harley-1980]

- Oxidative damage theory,[ Herman-1998]

- Disposable soma theory,[Kirkwood-1998]

- Redusome aging theory.

- Khalyavkin’s theory of aging
Theories for Slow Aging:

- Hermesis theory

- Klotho gene, [suppressing IGF-1 & Insulin Signaling] theory

Aging Population and Life of a Senior Citizen -

(Epidemiologic Profiles):

India is studied epidemiologically for aging population and according to existing statistics of present year [2017] it is labeled as a country with aging population by United Nations. The report of Registrar General of Census Operations, Govt. Of India [24] also supports this observation.

United Nations [25] considers 60 years as age of transition to elderly age group. Also, the population of aged persons is 9.0 %, [6.7 % in less developed countries and 15.0 % in developed countries. UN has declared that when 7% or more than that of total population are elderly (more than 60 years) that country’s population is labeled as aging population. India has 7.8 % of total population who are aged 60 years or more.

According to Bhasker Rao Thirunavalli and Usha Rani Chandalawada [26] population of India census which started by 1-3-2011; figures is 1.21 billion; of which, 31.6 % live in urban and 68.84 live in rural area.
The life expectancy of Indians is 64.2 years; whereas, the life expectancy of Indian urban males is 67.1% and life expectancy of urban Indian female is 70 years. Life expectancy as they mention; is highest in state of Kerala.

ASDR [Age Specific Death Rate] Is Highest In Old Persons; And,

DALY [Death Adjusted Living Years] in India by communicable disease is 50.5 years and by non communicable disease are 40.4 years.

Gopal Ingle and Anita Nath [27] mention that by year 2050 the number of elderly people would rise to 324 millions.

AH Suryakantha [28] states that though the population percentage is more in developed countries, the majority of old people live in developing country.

According to Oeppen and Vaupel JA W [29] due to improvement in hygiene and health care, human life expectancy has increased at steady rate of about 2.5 years per decade since the middle of Nineteenth Century.

According to Government of India Statistics, respiratory disorder mortality in elderly is 10% and cardio-vascular disorder mortality in elderly is 1/3rd of elderly mortality.

The Vulnerable Group or Disadvantaged Group is elderly females. [Kumar]


Cerebrovascular accidents are having morbidity-[4689] (death-1000)

Other four main causes of morbidity according to these authors are-
Ischemic Heart Disease-[5825] (death-1000)

COPD [2399] (death-1000)

Lower Respiratory Infections [1396] (death-1000)

Respiratory System Cancer [928] (death- 1000)

The book also mentions that iatrogenic disease is common in older people.

There is greater rate of aging in lower and middle income group; there is compression of morbidity and disability in aging population.

The authors have also presented the strategic methods in early, adult and old age population to increase capacity for health. This point carries significance when we think for homeostenotic issues which in older age group diminish functional reserve.

From all above observations of epidemiology it appears that aging population in India is a large population. Their number and their issues are also more and complex. They have meager resources and are critical individuals who are more vulnerable to aging issues related to heart, lung and blood. Also, these three organ systems-Heart, Lung, and Blood- are inter related as well as inter dependant and hence they are frequently studied as one problem area; secondly these being vital organs, any one of them can induce profound influence in Patho - Physiology of other organs.

In West; as such, there is National Heart, Lung and Blood Institute working for such and similar projects and purpose.
Structured Instruments To Assess Physical Debility:

This type of studies give importance to *Quality Of Life* and assessment and adjunct to *study damages due to debility, or frailty.*

- **Mental state:** Hamilton Depression Rating Scale [*HAMD*] has 17 structured items in this scale; useful for study of change of mood, depression etc. over period of time. The questionnaire is designed for the adults and is used to rate the severity of their depression by probing their mood, feelings of guilt, suicide ideation, insomnia, agitation or retardation, anxiety, weight loss, and somatic symptoms

- **Mini Mental State Examination [MMSE]**
  
  Useful for mild cognition and dementia like mental issues.

- **Physical Activity Scale For Elderly[PASE]**
  
  10 items for physical activity→ related to walking-house work- sports-for 1 week period assessment by questionnaire. The PASE is a brief and easily scored survey designed to access physical activity in persons aged 65 years and above.

- **Quality Of Life Assessment [ QOLPSV-]**
  
  54 items related to quality of life; it focuses more on Quality other than absence of disease.

- **Geriatric Anxiety Inventory: [GAI]**
  
  Has 20 items to detect +/- [anxiety state]

- **Mobility Questionnaire:** self reported; walk of ¼ mile and / or climbing staircase.

- **Short Physical Battery:**
  
  Walking 4 meter-rise from chair 5 times-
Balance for 10 seconds.

*Walking Speed Test:* walk for 4 minutes speedily. 6 minutes walking test-endurance test for speed and physical exercise.

400 meters of corridor walk.

**ADL AND IADL** [Activities of Daily Living and Instrument Assisted Daily Living].

- **Fraility Score:**
  
  Body Composition-
  
  Homeostasis Dysregulation-
  
  Energetic Failure-
  
  Neuro-Degeneration

This score is useful because fraility may lead to-

a) Ineffective Homeostatic Response to Stressors, |

b) To, Multiple Co morbidities, |

c) Physical Disabilities, |

d) Geriatric Syndromes.

As this study pertains to examine the status of diminished functional reserves in senior citizens of Vadodara city, such subjective or qualitative assessments are not included.

*About Vadodara City*

Vadodara is a rapidly industrializing and urbanizing and one of the first ten smart cities as proposed by government of India which is the designate cleanest city of India having population of about 22 lakh individuals and about 2 Lakh of floating population residing at out skirt areas close to Vadodara borders[31], located in Central Gujarat. It is educational and industrial hub with majority of middle class serving persons.

City being capital of an old royal state of Shri Sayajirao Gaekwad who is regarded as a king of vision, it is well designed beautiful city with moderate climate, plethora of greenery, cultured and sober gentry, and ample of amenities with reasonable scope for tranquil retired life, due to numerous Governmental, Semi Governmental, N.G.O. Voluntary organization or private bodies with dynamic activities and programs for senior citizens, taking care and fulfilling aspirations of retired persons. There are modern Medical Institutions and Center of excelling medical care providing services at moderate charges. Some of them are often free for senior citizens of Vadodara city. As such, it is one of the preferred cities by senior citizens for their retired life. According to estimation by candidate, there may be population of about 2.5 Lakh senior citizens in Vadodara city.

It is also to be noted the year marking for elderly senior begins by 60 years but all persons at 60 years do not lead retired life of retreat, rather many remain functionally active till the situation of health may permit and for one or other reasons.
The existence and extent of homeostenosis in current senior citizen population not being elaborately studied, by utilizing modern equipments and gadgets of sufficient reliability, specificity and sensitivity, such study is the need of the time, because there is paucity of such assessment and study.

Also, this may aid in establishing base line study for starting future major studies for equivalent parameters or composite programs of more complex study related to senior citizens of Vadodara or elsewhere. It is well known that in every city there are areas, where the socio-economic distribution is unequal. So is also the case in Vadodara, where, there may be regions locally well suited to individuals by their socio economic background.

The increased longevity is not uniform across socio-economic groups or different countries according to authors [32] of Oxford Text Book of Public Health, and hence the existence and extent of homeostenosis may vary regionally. The sample selection may also be a challenge. As such, one study may not correlate with another one.