OBESITY

IMPLICATIONS, CAUSES, SOLUTIONS

Nirankar S. Agarwal, Ph.D.

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We squander health in search of wealth.
We scheme and toil and save,
then squander wealth in search of health
and all we get is a grave.
We live and boast of what we own,
We die and only get a stone.

Anonymous

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Chapter 1

Obesity and its Implications

The whole world is steadily becoming more obese, a new study shows, but not surprisingly, the U.S. is No. 1.

The survey of 188 countries shows that nearly 30 percent of the global population, or 2.1 billion people, are either overweight or obese. Not a single country has lowered its obesity rate since 1980, the first of its kind study shows.

And even though the United States accounts for just 5 percent of the world's total population, Americans make up 13 percent of the global overweight and obese population.

Perhaps most troubling, kids are heavier than ever, the survey by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington finds. The percentage of overweight or obese children and teenagers has increased by nearly 50 percent since 1980 and now more than 22 percent of girls and nearly 24 percent of boys in developed countries are overweight or obese.

– Maggie Fox, NBC News Health, May 28, 2014

Suddenly, in the 21st century, the word *extinction* as a threat to the survival of human race is being heard more frequently. Not due to the scare of nuclear debacle as was the case during second half of the 20th century but through an impending disaster instigated by a novel menace, *obesity*, and its deleterious consequences on world's ecosystems and the human species. And it is ironic that this alarming threat stems more from affluence and prosperity rather than from scarcity in many regions of the world!

Experts have started using the term coined by World Health Organization (WHO),'globesity', to denote its occurrence worldwide. WHO proclaims that overweight and obesity (another new term, 'overfat' has been used by Dr. Phil Maffetone, to include overweight & obesity,

Numbers indicate % adult population in 2010

Country	Overweight	Obese
Australia	49	16.4
China	18.9	2.9
Egypt	66	30.3
Germany	66.5	12.9
India	4.5	0.7
Iran	42.8	14.2
Japan	23.2	3.1
U.K.	61	22.7
U.S.A.	66.9	33.9

Source: http://apps.who.int/bmi/index.jsp [accessed 5 June 2015]

Obesity escalation in USA	
Obesity then	**Obesity now**
In the early 1970s, the prevalence of obesity was 5% for children ages 2 to 5 years, 4% for children ages 6 to 11 years, and 6% for adolescents ages 12 to 19 years.	In 2007–2008, the prevalence of obesity reached 10% for children ages 2 to 5 years, 20% for children ages 6 to 11 years, and 18% for adolescents ages 12 to 19 years.
In the late 1970s, 15% of adults were obese.	In 2008, 34% of adults were obese.
In the early 1990s, zero States had an adult obesity prevalence rate of more than 25%.	In 2008, 32 States had an adult obesity prevalence rate of more than 25%.
Ref.: USDA & USDHHS *Dietary Guidelines for Americans*, 2010. 7th Edition	

both) has recently emerged to be the 5th leading cause of mortality. No less than 2.8 million deaths in 2008 were attributed to obesity worldwide. In 2014, out of a total population of over 7.15 billion people, some 1.9 billion (27% of population) were overweight. Of these overweight individuals, almost one third or 600 million (8.4% of the entire world population) were grossly overweight (obese).

		Year when the prevalence will reach		
US Adults		**80%**	**90%**	**100%**
Overweight	All	2022	2035	2048
(BMI≥25 kg/m^2)	Men	2020	2035	2051
	Women	2022	2033	2044
US Adults		**80%**	**90%**	**100%**
Obesity	All	2072	2087	2102
(BMI≥30 kg/m^2)	Men	2071	2092	2107
	Women	2058	2071	2084
US Children 6-11 years		**30%**	**40%**	**50%**
Overweight	All	2031	2052	2074
	Boys	2029	2049	2069
	Girls	2035	2060	2084
US Adolescents 12-19 years		**30%**	**40%**	**50%**
Overweight	All	2028	2048	2068
	Boys	2027	2046	2066
	Girls	2035	2057	2080

[Youfa Wang et al, *Obesity* (2008) **16** 10, 2323–2330; http://www.nature.com/oby/journal/v16/n10/full/oby2008351a.html]

Although a few small countries are more overfat – American Samoa, 93.5%; Kiribati, 81.5%; among the more populous nations, the United States leads hands down with more than 2/3rd of its population overweight. More than half of overweight Americans, that is 34%, are grossly overweight or obese [see table below]. These figures for USA translate in to about 200 million overweight individuals of which a whopping 100 million are obese. What is even more worrisome is the trend towards obesity across all age groups. Whereas overweight (as classified by Body Mass Index of 25-29.9; see later) proportion of the population has remained fairly stable at one-third from 1971–1974 to 2003–2006, incidence of obesity has more than doubled from 15% to 34% over the same period. Even more alarming is the frightful increase in obesity from 8% to 24% in young adults (18-29 years) over the same stretch. Future predictions portray [see table] a similar tendency. Youfa Wang and coworkers extrapolated the past trend and estimated that 80% of American adults may be overweight by 2022, almost 90% by 2030, and 100% by 2048. Incidence of overweight & obesity in children and adolescents are projected to rise from the current 19% to 30% by 2030, and to 50% by 2070. (Youfa Wang, May A. Beydoun, Lan Liang, Benjamin Caballero and Shiriki K. Kumanyika, *Obesity* (2008) 16 10, 2323–2330. doi:10.1038/oby.2008.351)

Tan Ee Lyn in a Reuters news capsule (Aug. 26, 2011) cited a study, published in the prestigious journal *Lancet*, echoing a similarly dismal prospect in which the study author Clair Wang of Columbia University warned

that if the present trend continued, half of the entire population of the United States will be obese by 2030. Britain will reportedly be a close second where "obesity rates will balloon to between 41–48% for men and 35–43% for women by 2030 from what are now 26% for both sexes." An increase of more than 50% in obesity in a mere 20 years is an extremely gloomy outlook in two of the world's leading economies, which moreover serve as role models for much of the global population.

How are the terms 'overweight' and 'obese' defined?

Based on much scientific and statistical research, the most widely used classification for overweight and obese is generated from the readily measured figures of height and weight. These parameters are fed in to a simple equation to determine a quantity called '**body mass index**, or BMI'.

$$\text{BMI} = \frac{\text{Body weight in pounds x 703}}{\text{Height in inches x height in inches}}$$

For example, BMI for a person weighing 160 pounds and 5 feet 10 inches tall, can be calculated as follows:

$$\text{BMI} = \frac{\text{160 pounds x 703}}{\text{70 inches x 70 inches}} = \frac{112{,}480}{4{,}900} = 22.96$$

In the decimal system, the equation to calculate BMI is the following:

$$\text{BMI} = \frac{\text{Body weight in kilograms}}{\text{Height in meters x height in meters}}$$

And an example to determine BMI for a 85 kilogram (kg) person who is 1.8 meters tall, would be:

$$\text{BMI} = \frac{85 \text{ kilograms}}{1.8 \text{ meters x } 1.8 \text{ meters}} = \frac{85}{3.24} = 26.23$$

In scientific papers, the figure for BMI may be specified by suffix of kg/m^2, for example, the number above may be written as BMI of 26.23 kg/m^2. In general literature, however, the suffix, kg/m^2, is omitted. Pre-calculated numbers of BMI (from height in inches and weight in pounds; and also height in meters and weight in kilograms) are given in Tables 1 & 2 at the end of the chapter.

Based on BMI parameters, adults are generally classified in to various categories as follows: [http://www.nlm.nih.gov/medlineplus/ency/article/003101.htm]:

BMI	Weight Status
18.5–24.9	Normal
25.0–29.9	Overweight
30.0–39.9	Obese
40.0 and more	Extremely obese
100+ pounds overweight	Morbidly obese

Please note: 100 pounds = 45 kilograms

It should be understood that classifications based on these numbers are approximations. For, a person of larger skeletal frame, though of the same height as an individual with smaller skeletal frame, may carry higher weight without being overweight or obese. Or, an individual may have a highly developed muscle-tone thereby

adding to the gross weight. In general, however, higher than normal weight is indicative of relatively more fat in the body.

If the 'weight status' presented above is for adults only, what about children and youngsters?

IMPORTANT CAVEAT FOR THE INTERPRETATION OF BMI FOR CHILDREN & TEENS (2-20 YEARS): Centers for Disease Control and Prevention (CDC) of the U.S. Government cautions that "Because there are changes in weight and height with age, as well as their relation to body fatness, BMI levels among children and teens need to be expressed relative to other children of the same sex and age. These percentiles are calculated from the CDC growth charts, which were based on national survey data collected from 1963-65 to 1988-94" [Ref.: Kuczmarski, R.J. et al., 2002. 2000 CDC Growth Charts for the United States: methods and development. Vital Health Stat. 11., 11(246), pp.1–190; http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html]

What this practically means is that because of the growth factor in children, measurements of weight and height have to be more exact for BMI calculation (See CDC guidelines for measuring height and weight), and the interpretation of BMI depends on age and sex also. As mentioned above, for children & teens, percentile figures can be obtained from the 'CDC growth charts' (see page x for boys and x=1 for girls) which have graphs of BMI values on 'Y' axis plotted against age on 'X' axis, and 'weight status category' determined from the table below.

Percentile Range	Weight Status Category
Less than 5th percentile	Underweight
5th – 84.9th percentile	Normal or Healthy Weight
85th – 94.9th percentile	Overweight
95th or more percentile	Obese

A couple examples will make the above narrative clear.

Example 1

Birth Date: September 21, 2001
Date of Measurement: July 14, 2015
Age & gender: 13 years 10 months; girl
Height: 5 feet 1-1/8 inch(es)
Weight: 125-1/2 pounds

$$\text{BMI} = \frac{125.5 \text{ pounds x } 703}{61.125 \text{ x } 61.125} = \frac{88226.5}{3736.27} = 23.61$$

BMI of 23.6 for this girl places BMI-for-age at the 86th percentile from the chart on page x. This girl's 'weight-status-category' is hence **overweight**.

Example 2

Birth Date: July 05, 2000
Date of Measurement: July 14, 2015
Age & gender: 15 years 0 month; boy
Height: 160.1 centimeters=1.601 meters
Weight: 61.4 kilograms

$$\text{BMI} = \frac{61.4 \text{ kilograms}}{1.601 \text{x} 1.601} = \frac{61.4}{2.56} = 24.0$$

BMI of 24 for this boy places BMI-for-age at the 87th percentile from the chart on page x. This boy's 'weight-status-category' is therefore **overweight**.

Yet another example from CDC's website is included on page z.

What is wrong with excessive fat in the body?

Actually most fat cells are a means of energy storage in the body. When excess calories are taken in than burnt up, the surplus is stored as fat. During evolution, human body developed the mechanism of fat storage for generation of energy during lean periods. It is only in recent times, by and large, that plentiful food is available to a sizable population. I recollect reading a news capsule around 'Thanksgiving' in the United States in 1984 that the Thanksgiving Dinner with its variety and richness of fare in a typical American home today could have been enjoyed only by the aristocracy and royalty in Europe two hundred years ago!

Now, the conditions are such that people, who can afford to eat well, can continue to do so more or less through their entire life without any lean periods in food availability. If excess fat is inculcated in the body, it is likely to stick unless drastic measures are undertaken to expend excess energy. All systems in Nature have a limit to how much stress they can tolerate without being swamped. Take for instance, rivers. Running river water has the capability to clean up a certain amount of pollutants so that living beings in the river are not irrevocably harmed. Even higher levels of pollutants for short durations can occasionally be rendered harmless. But excessive pollution over a long period will kill the living beings in the river, as happened with the river Rhine in Germany during the 1960s and 1970s. It was heartening to note that by sustained effort to clean up

the pollutants, fishes came back to Bonn & Cologne area of the Rhine in the 1980s.

A similar situation exists with human body. One can do with less than necessary sleep for some days without causing permanent debility. Body has the capability to recover even from non-fatal poisoning, or the attack of numerous pathogens in our environment. But fat accumulation in the long run puts the body under perpetual stress. Just supplying nutrients to and removing waste from a larger body mass is stressful for the body organs and systems. Overweight or obese people see this strain daily when they carry their body around and get tired sooner or more easily. As an indicator, a 200 pound individual needs to expend 420 calories to walk 3 miles, whereas a 150 pound person uses 320 calories for the same distance and at the same pace. Excess weight due to fat affects all systems and can wear down the body organs faster. This leads to a plethora of unhealthy conditions surfacing over time. Unfortunately, many chronic conditions are irreversible. Some maladies can be managed with judicious regimen of treatment and lifestyle changes, but usually there is no cure. Yet others may be intractable.

What are the health implications of obesity?

Initiation, progression and manifestation of chronic diseases can have multiple causes associated with them. It is difficult to accurately state that a particular disease was specifically caused by exessive fat alone. Quite reliable estimates, however, can be obtained by statistical comparisons of the incidence of disease in normal and overweight populations.

Obese individuals have been shown to have 50% to 100% higher risk of mortality than normal weight people in most studies. These studies further reveal that an individual's lifespan could be shortened by 2 – 20 years depending on the burden of excess weight [http://www.win.niddk.nih.gov/]. For instance, S. Jay Olshansky and coworkers reported in *The New England Journal of Medicine* (2005) that for the first time in recorded history life expectancy in the United States has shown a tendency to decline and warned that if the scourge of obesity is not arrested forthwith, there may be decline of as much as 5 years in life expectancy in a few decades. Other researchers have suggested that as many as 300,000 deaths per year in the USA could be attributed to obesity alone.

Tan Ee Lyn (Reuters, Aug. 26, 2011, loc. cit.) reported that "Obesity is fast replacing tobacco as the single most important preventable cause of chronic non-communicable diseases, and will add an extra 7.8 million cases of diabetes, 6.8 million cases of heart disease and stroke, and 539,000 cases of cancer in the United States by 2030."

Weight-control Information Network (WIN) of the National Institutes of Health of United States Government [http://www.win.niddk.nih.gov/] has identified a large number of maladies that can result from obesity. These include:

* Type 2 diabetes: This condition is generally referred to as 'high blood sugar' or just as a 'sugar' problem. It is the most common form of diabetes. It generally manifests in adulthood due to poor utilization of blood glucose. However, with escalating obesity in younger

population, incidence of Type 2 diabetes is also surfacing earlier than before. In India, more than 7% of the population suffers from diabetes and the gloomy projection is that by 2020, this will rise to almost 9%.

* Coronary Heart Disease – arteries supplying nutrients to the heart muscle become narrow due to plaques formed from cholesterol, fat, and other substances. As body mass increases, inhibited blood supply can lead to heart attack.
* High Blood Pressure (thickening of arteries) – Studies in the United States have shown that overweight people have a more than 50% risk of being hypertensive, whereas obesity more than doubles the prevalence of hypertension.
* High blood cholesterol – Increased risk, similar to hypertension, of blood cholesterol has also been found in the United States.
* Stroke – if the plaque bulge in an artery near the brain bursts, the resulting clot may block blood supply to the brain. Overweight and obesity increase the risk of stroke.
* Cancer of: colon, prostrate, rectum in men – risk increases with excessive fat.
* Cancer of: uterus, cervix, ovary in women – increased risk in overweight and obese.
* Cancer of esophagus (upper digestive tract): risk increases with overweight and obesity.
* Gallbladder disease – overweight people face higher risk of gallstone formation, mainly from cholesterol.

* Fatty liver disease (the nonalcoholic variety) risk is higher as well.
* Orthopedic problems: more fractures and muscle-skeletal disorders have been reported in overweight children and adolescents.
* Osteoarthritis – excess weight enhances risk of degeneration of knee, hip and lower back joints.
* Gout (inflammatory arthritis) incidence higher in overweight individuals.
* Pulmonary problems, including sleep apnea (momentary pause in breathing), increase with higher body mass.
* Reproductive system problems surface in overweight women.
* Mental health problems, depression, reduced self-esteem are also caused by excess weight.

Youfa Wang and co-workers in the study mentioned earlier also estimated medical costs exclusively attributable to above conditions as a consequence of the scourge of overweight & obesity. Their estimates show that the year 2000 costs pegged at 72–81 billion dollars are projected to escalate to between 394–438 billion dollars by 2020 and between 861–957 billion dollars by 2030, a more than 10 fold increase in 30 years. This projected expenditure will also represent 1 out of 6 dollars earmarked for all healthcare spending. The authors also noted that these medical costs were calculated for adults only, and children and adolescents were not included in these estimates. Nor was any attempt made to estimate costs incurred due to loss of productivity, absenteeism,

and premature death, etc., an inevitable consequence of disease. These too will obviously add a significant supplementary monetary burden on the society.

Isn't there some concern as to where the excess fat is located in the body?

Oh yes, from statistical studies over the past several years it has become apparent that an increase in belly fat engenders more risk for health. Experts, therefore, warn that a waist size of 40 or more for men and 35 or higher for women is a dangerous risk factor irrespective of the BMI figure. More recently still, attention has shifted to the body shape. A pear shaped body has more fat in the hip and buttock area. Whereas an apple shaped body carries more fat around the abdominal area. Scientists have found that it is the proportion of fat in each area, waist to hip ratio (WHR), that gives a better indication of health risks associated with excess weight.

How to find 'waist to hip ratio'?

Actually it is quite simple. With a measuring tape, encircle your abdomen with the tape on the belly button or slightly above, depending on where the bulge is maximum. Be careful to keep the tape parallel to the ground and do not press the abdomen with the tape. Measure the hip area at its most outward protrusion with the same precautions as before. Now divide the waist measurement by the hip measurement and consult the following chart.

Waist to Hip Ratio Chart		
Male	**Female**	**Health Risk Based on WHR**
0.95 or below	0.80 or below	Low Risk
0.96 to 1.0	0.81 to 0.85	Moderate Risk
1.0+	0.85+	High Risk

The numbers in this chart only signify that an apple shaped body is prone to a higher risk of disease than a pear shaped body. Excess body weight is a health risk factor in its own right.

TABLE 1

To use the table, find the appropriate height in the left-hand column labeled Height. Move across to a given weight (in pounds). The number at the top of the column is the BMI at that height and weight. Pounds have been rounded off.

Source: http://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmi_tbl2.htm

BMI	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Height (inches)	**Body Weight (pounds)**											
58	91	96	100	105	110	115	119	124	129	134	138	143
59	94	99	104	109	114	119	124	128	133	138	143	148
60	97	102	107	112	118	123	128	133	138	143	148	153
61	100	106	111	116	122	127	132	137	143	148	153	158
62	104	109	115	120	126	131	136	142	147	153	158	164
63	107	113	118	124	130	135	141	146	152	158	163	169
64	110	116	122	128	134	140	145	151	157	163	169	174
65	114	120	126	132	138	144	150	156	162	168	174	180
66	118	124	130	136	142	148	155	161	167	173	179	186
67	121	127	134	140	146	153	159	166	172	178	185	191
68	125	131	138	144	151	158	164	171	177	184	190	197
69	128	135	142	149	155	162	169	176	182	189	196	203
70	132	139	146	153	160	167	174	181	188	195	202	209
71	136	143	150	157	165	172	179	186	193	200	208	215
72	140	147	154	162	169	177	184	191	199	206	213	221
73	144	151	159	166	174	182	189	197	204	212	219	227
74	148	155	163	171	179	186	194	202	210	218	225	233
75	152	160	168	176	184	192	200	208	216	224	232	240
76	156	164	172	180	189	197	205	213	221	230	238	246

TABLE 1 (contd.)

BMI	31	32	33	34	35	36	37	38	39	40	41	42
Height (inches)	**Body Weight (pounds)**											
58	148	153	158	162	167	172	177	181	186	191	196	201
59	153	158	163	168	173	178	183	188	193	198	203	208
60	158	163	168	174	179	184	189	194	199	204	209	215
61	164	169	174	180	185	190	195	201	206	211	217	222
62	169	175	180	186	191	196	202	207	213	218	224	229
63	175	180	186	191	197	203	208	214	220	225	231	237
64	180	186	192	197	204	209	215	221	227	232	238	244
65	186	192	198	204	210	216	222	228	234	240	246	252
66	192	198	204	210	216	223	229	235	241	247	253	260
67	198	204	211	217	223	230	236	242	249	255	261	268
68	203	210	216	223	230	236	243	249	256	262	269	276
69	209	216	223	230	236	243	250	257	263	270	277	284
70	216	222	229	236	243	250	257	264	271	278	285	292
71	222	229	236	243	250	257	265	272	279	286	293	301
72	228	235	242	250	258	265	272	279	287	294	302	309
73	235	242	250	257	265	272	280	288	295	302	310	318
74	241	249	256	264	272	280	287	295	303	311	319	326
75	248	256	264	272	279	287	295	303	311	319	327	335
76	254	263	271	279	287	295	304	312	320	328	336	344

You can also use ON-Line Calculator for calculating BMI
<https://nccd.cdc.gov/dnpabmi/calculator.aspx>

TABLE 1 (contd.)

BMI	43	44	45	46	47	48	49	50	51	52	53	54
Height (inches)	**Body Weight (pounds)**											
58	205	210	215	220	224	229	234	239	244	248	253	258
59	212	217	222	227	232	237	242	247	252	257	262	267
60	220	225	230	235	240	245	250	255	261	266	271	276
61	227	232	238	243	248	254	259	264	269	275	280	285
62	235	240	246	251	256	262	267	273	278	284	289	295
63	242	248	254	259	265	270	278	282	287	293	299	304
64	250	256	262	267	273	279	285	291	296	302	308	314
65	258	264	270	276	282	288	294	300	306	312	318	324
66	266	272	278	284	291	297	303	309	315	322	328	334
67	274	280	287	293	299	306	312	319	325	331	338	344
68	282	289	295	302	308	315	322	328	335	341	348	354
69	291	297	304	311	318	324	331	338	345	351	358	365
70	299	306	313	320	327	334	341	348	355	362	369	376
71	308	315	322	329	338	343	351	358	365	372	379	386
72	316	324	331	338	346	353	361	368	375	383	390	397
73	325	333	340	348	355	363	371	378	386	393	401	408
74	334	342	350	358	365	373	381	389	396	404	412	420
75	343	351	359	367	375	383	391	399	407	415	423	431
76	353	361	369	377	385	394	402	410	418	426	435	443

TABLE 2

Change inch to meter by : 1 inch = 0.0254 meter
Change pound to kilogram by: 1 Lb. = 0.454 Kg

BMI	19	20	21	22	23	24	25	26	27	28	29	30
Height (meters)	Body Weight (kilograms)											
1.47	41.4	43.6	45.5	47.7	50.0	52.3	54.1	56.4	58.6	60.9	62.7	65.0
1.50	42.7	45.0	47.3	49.5	51.8	54.1	56.4	58.2	60.5	62.7	65.0	67.3
1.52	44.1	46.4	48.6	50.9	53.6	55.9	58.2	60.5	62.7	65.0	67.3	69.5
1.55	45.5	48.2	50.5	52.7	55.5	57.7	60.0	62.3	65.0	67.3	69.5	71.8
1.57	47.3	49.5	52.3	54.5	57.3	59.5	61.8	64.5	66.8	69.5	71.8	74.5
1.60	48.6	51.4	53.6	56.4	59.1	61.4	64.1	66.4	69.1	71.8	74.1	76.8
1.63	50.0	52.7	55.5	58.2	60.9	63.6	65.9	68.6	71.4	74.1	76.8	79.1
1.65	51.8	54.5	57.3	60.0	62.7	65.5	68.2	70.9	73.6	76.4	79.1	81.8
1.68	53.6	56.4	59.1	61.8	64.5	67.3	70.5	73.2	75.9	78.6	81.4	84.5
1.70	55.0	57.7	60.9	63.6	66.4	69.5	72.3	75.5	78.2	80.9	84.1	86.8
1.73	56.8	59.5	62.7	65.5	68.6	71.8	74.5	77.7	80.5	83.6	86.4	89.5
1.75	58.2	61.4	64.5	67.7	70.5	73.6	76.8	80.0	82.7	85.9	89.1	92.3
1.78	60.0	63.2	66.4	69.5	72.7	75.9	79.1	82.3	85.5	88.6	91.8	95.0
1.80	61.8	65.0	68.2	71.4	75.0	78.2	81.4	84.5	87.7	90.9	94.5	97.7
1.83	63.6	66.8	70.0	73.6	76.8	80.5	83.6	86.8	90.5	93.6	96.8	100.5
1.85	65.5	68.6	72.3	75.5	79.1	82.7	85.9	89.5	92.7	96.4	99.5	103.2
1.88	67.3	70.5	74.1	77.7	81.4	84.5	88.2	91.8	95.5	99.1	102.3	105.9
1.91	69.1	72.7	76.4	80.0	83.6	87.3	90.9	94.5	98.2	101.8	105.5	109.1
1.93	70.9	74.5	78.2	81.8	85.9	89.5	93.2	96.8	100.5	104.5	108.2	111.8

TABLE 2 (contd.)

Change kilogram to pounds by: 1 Kg = 2.2 pounds
Change meter to inch by : 1 meter = 39 inches
100 centimeters = 1 meter

BMI	31	32	33	34	35	36	37	38	39	40	41	42
Height (meters)	Body Weight (kilograms)											
1.47	67.3	69.5	71.8	73.6	75.9	78.2	80.5	82.3	84.5	86.8	89.1	91.4
1.50	69.5	71.8	74.1	76.4	78.6	80.9	83.2	85.5	87.7	90	92.3	94.5
1.52	71.8	74.1	76.4	79.1	81.4	83.6	85.9	88.2	90.5	92.7	95	97.7
1.55	74.5	76.8	79.1	81.8	84.1	86.4	88.6	91.4	93.6	95.9	98.6	101
1.57	76.8	79.5	81.8	84.5	86.8	89.1	91.8	94.1	96.8	99.1	102	104
1.60	79.5	81.8	84.5	86.8	89.5	92.3	94.5	97.3	100	102	105	108
1.63	81.8	84.5	87.3	89.5	92.7	95	97.7	100	103	105	108	111
1.65	84.5	87.3	90	92.7	95.5	98.2	101	104	106	109	112	115
1.68	87.3	90	92.7	95.5	98.2	101	104	107	110	112	115	118
1.70	90	92.7	95.9	98.6	101	105	107	110	113	116	119	122
1.73	92.3	95.5	98.2	101	105	107	110	113	116	119	122	125
1.75	95	98.2	101	105	107	110	114	117	120	123	126	129
1.78	98.2	101	104	107	110	114	117	120	123	126	130	133
1.80	101	104	107	110	114	117	120	124	127	130	133	137
1.83	104	107	110	114	117	120	124	127	130	134	137	140
1.85	107	110	114	117	120	124	127	131	134	137	141	145
1.88	110	113	116	120	124	127	130	134	138	141	145	148
1.91	113	116	120	124	127	130	134	138	141	145	149	152
1.93	115	120	123	127	130	134	138	142	145	149	153	156

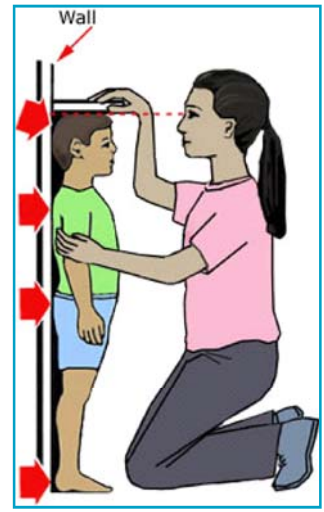
TABLE 2 (contd.)

BMI	43	44	45	46	47	48	49	50	51	52	53	54
Height (meters)	Body Weight (kilograms)											
1.47	93.2	95.5	97.7	100.0	101.8	104.1	106.4	108.6	110.9	112.7	115.0	117.3
1.50	96.4	98.6	100.9	103.2	105.5	107.7	110.0	112.3	114.5	116.8	119.1	121.4
1.52	100.0	102.3	104.5	106.8	109.1	111.4	113.6	115.9	118.6	120.9	123.2	125.5
1.55	103.2	105.5	108.2	110.5	112.7	115.5	117.7	120.0	122.3	125.0	127.3	129.5
1.57	106.8	109.1	111.8	114.1	116.4	119.1	121.4	124.1	126.4	129.1	131.4	134.1
1.60	110.0	112.7	115.5	117.7	120.5	122.7	126.4	128.2	130.5	133.2	135.9	138.2
1.63	113.6	116.4	119.1	121.4	124.1	126.8	129.5	132.3	134.5	137.3	140.0	142.7
1.65	117.3	120.0	122.7	125.5	128.2	130.9	133.6	136.4	139.1	141.8	144.5	147.3
1.68	120.9	123.6	126.4	129.1	132.3	135.0	137.7	140.5	143.2	146.4	149.1	151.8
1.70	124.5	127.3	130.5	133.2	135.9	139.1	141.8	145.0	147.7	150.5	153.6	156.4
1.73	128.2	131.4	134.1	137.3	140.0	143.2	146.4	149.1	152.3	155.0	158.2	160.9
1.75	132.3	135.0	138.2	141.4	144.5	147.3	150.5	153.6	156.8	159.5	162.7	165.9
1.78	135.9	139.1	142.3	145.5	148.6	151.8	155.0	158.2	161.4	164.5	167.7	170.9
1.80	140.0	143.2	146.4	149.5	153.6	155.9	159.5	162.7	165.9	169.1	172.3	175.5
1.83	143.6	147.3	150.5	153.6	157.3	160.5	164.1	167.3	170.5	174.1	177.3	180.5
1.85	147.7	151.4	154.5	158.2	161.4	165.0	168.6	171.8	175.5	178.6	182.3	185.5
1.88	151.8	155.5	159.1	162.7	165.9	169.5	173.2	176.8	180.0	183.6	187.3	190.9
1.91	155.9	159.5	163.2	166.8	170.5	174.1	177.7	181.4	185.0	188.6	192.3	195.9
1.93	160.5	164.1	167.7	171.4	175.0	179.1	182.7	186.4	190.0	193.6	197.7	201.4

Note: Figures in meters and kilograms were calculated from data in tables 1 & 2 from the website: *http://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmi_tbl2.htm*

Guidelines for Home Measurements

Measuring Height



1. Remove shoes, bulky clothing, and hair ornaments, and unbraid hair
2. To stand on uncarpeted floor against plain wall
3. To stand with feet together & flat, and against the wall; legs straight, arms at side, and shoulders are level.
4. To look straight ahead, no tilt in head
5. As far as possible, head & shoulders & buttocks & heels ought to touch the wall (See illustration.)
6. Use a flat headpiece to form a right angle with the wall and lower the head-piece until it firmly touches the crown of the head.
7. Make sure the measurer's eyes are at the same level as the head-piece.
8. Lightly mark where the bottom of the headpiece meets the wall. Then, use a metal tape to measure from floor to the mark
9. Accurately record the height to the nearest 1/8th inch or 0.1 centimeter.

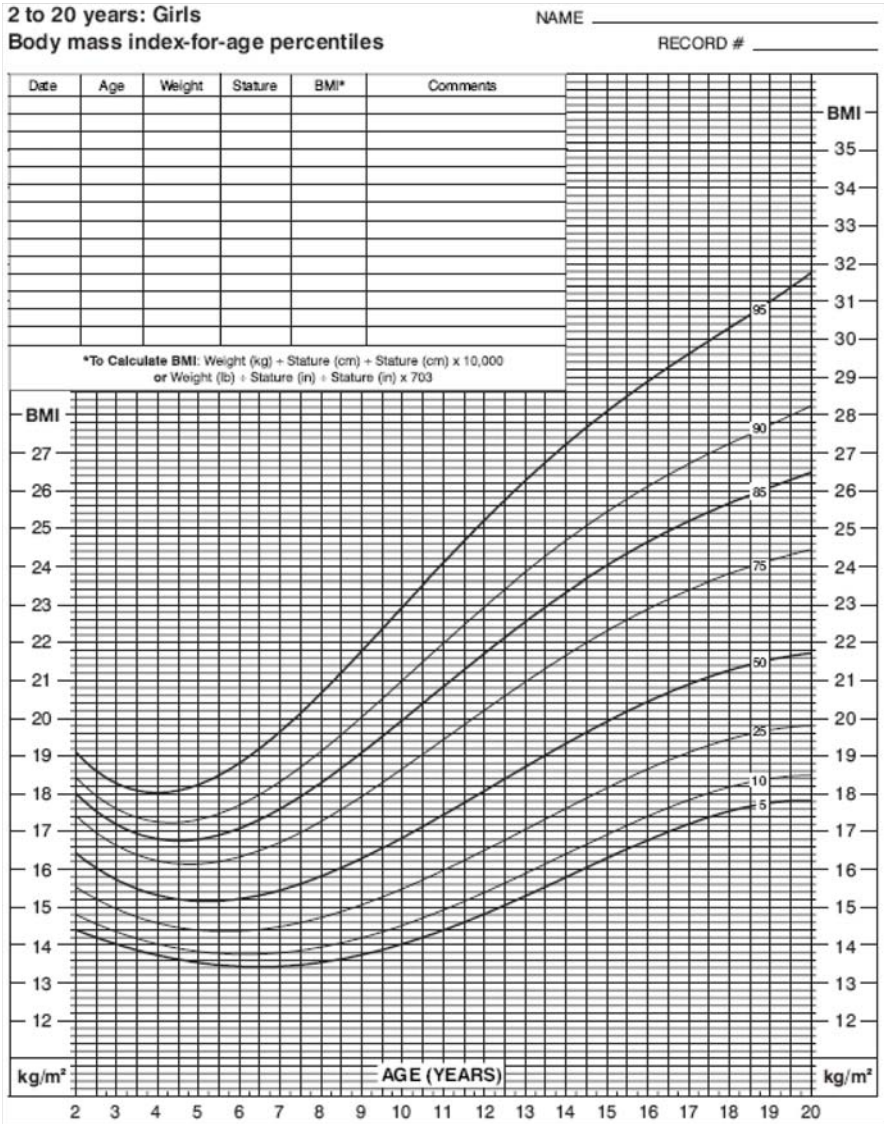
Measuring Weight

To measure weight accurately at home to calculate BMI-for-age:

1. Use a digital scale. Place the scale on firm flooring
2. Have the child or teen remove shoes and heavy clothing, such as sweaters.
3. Have the child or teen stand with both feet in the center of the scale.
4. Record the weight to the nearest decimal fraction (for example, 55.5 pounds or 25.1 kilograms).

[Adapted from: http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/measuring_children.html]

Percentile Range	**Weight Status Category**
Less than 5th percentile	Underweight
5th-84.9th percentile	Normal or Healthy Weight
85th-94.9th percentile	Overweight
95th or more percentile	Obese



http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

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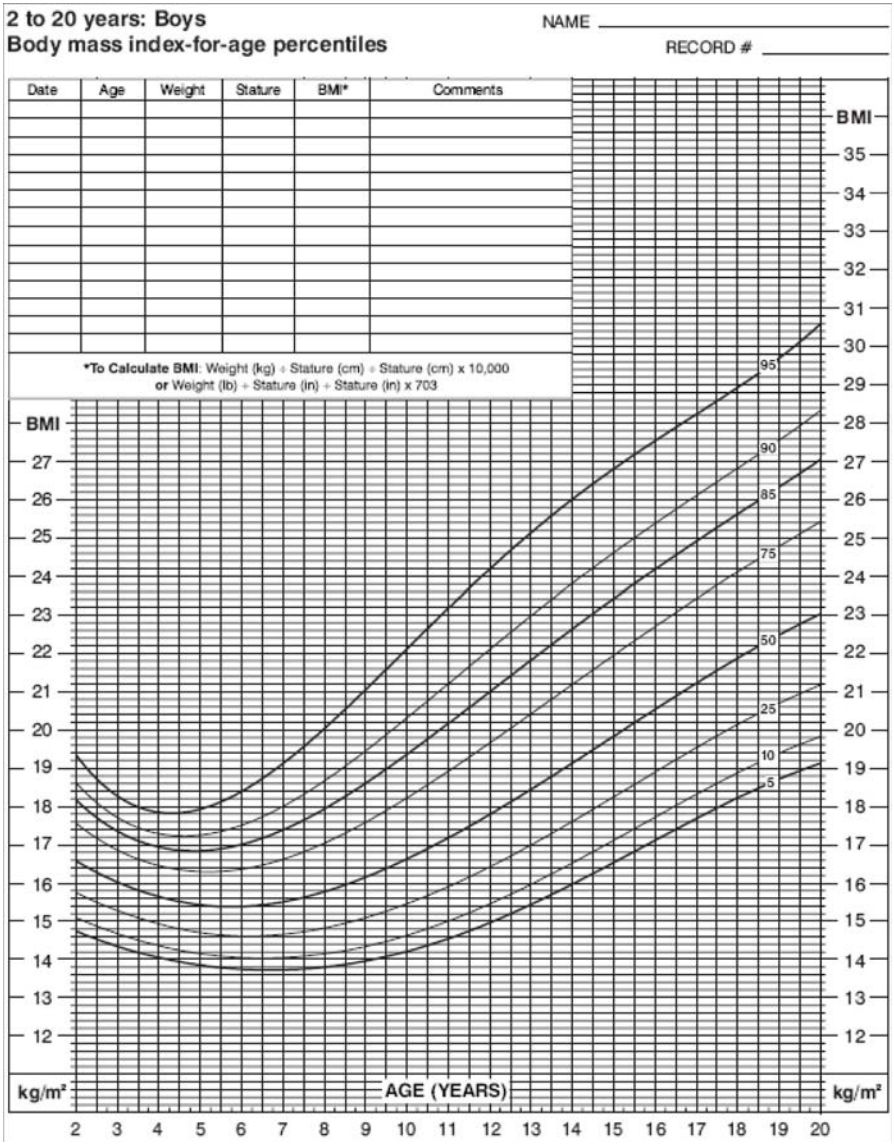
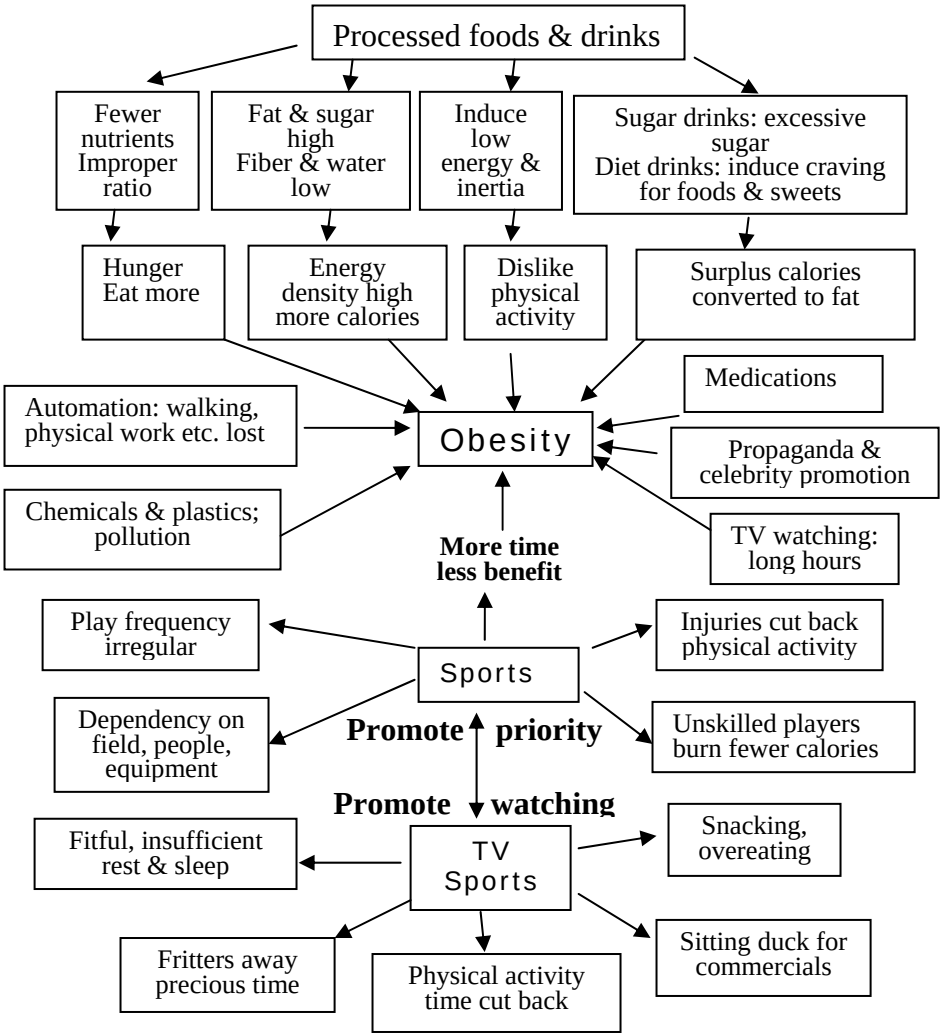


http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

Chapter 2

Causes of Obesity

Potential Causes of Obesity



Obesity is a complex health issue to address. Obesity results from a combination of causes and contributing factors, including individual factors such as behavior and genetics. Behaviors can include dietary patterns, physical activity, inactivity, medication use, and other exposures. Additional contributing factors in our society include the food and physical activity environment, education and skills, and food marketing and promotion.

– *Centers for Disease Control and Prevention* (*CDC*)
https://www.cdc.gov/obesity/adult/causes.html

Why do we gain weight ?

To understand the process of weight gain, let us first talk about energy we use and where does it come from?

For human beings, the source of energy is their diet. For general purposes, energy is expressed in terms of calories.

Our diet consists of four classes of nutrients which are broken down in the body to provide us energy. A fifth class, alcohol, though not necessary, is consumed by many as an optional item and is also a source of calories. Diverse nutrients furnish different number of calories per unit weight. Thus:

* Carbohydrates (simple & complex variety) – 4 calories per gram (1oz.=28g.)
* Proteins – 4 calories per gram
* Lipids (commonly known as oils or fats) – 9 calories per gram
* Dietary Fiber – 1.5 to 2.5 calories per gram
* Alcohol – 5.5 calories per gram
* Water – 0 calorie

Avoid confusion about the term 'Calorie'

A calorie is a unit of energy (or heat). Its scientific definition is: the amount of energy which raises the temperature of 1 gram (1 ounce=28 grams) of water by 1 degree Celsius or centigrade (or 1.8 degree Fahrenheit).

1,000 calories are therefore required to raise the temperature of 1,000 grams = 1 kilogram (or 2.2 pounds) =1 liter of water 1 degree centigrade.

1,000 calories = 1 kilocalorie or 1 kcal.

It is this *1 kcal* which is called a 'Calorie' when we refer to calories present in foods or burnt in physical activities. It is sometimes written with 'C' as a capital letter but can also be written with a lower case 'c', or just as 'kcal'.

Example: A 45 gram (a little over one and one half ounces) bar of chocolate has 230 Calories or calories.

Over the past several decades, much data has been collected and fed in to scientific equations to generate simple or elaborate tables for the basic calorie needs of individuals. The table below is taken from the *United States Department of Agriculture Dietary Guidelines for Americans 2010* and provides general calorie requirements by age, gender, and activity levels.

Consequence of varying levels of energy intake and energy expenditure in terms of body weight are as follows:

* Less energy **in** than **out** over time = **WEIGHT LOSS**
* Same amount of energy **in** and **out** over time = **WEIGHT UNCHANGED**
* More energy **in** than **out** over time = **WEIGHT *GAIN***

Dietary Guidelines for Americans 2010						
US Department of Agriculture guidelines for daily intake of calories by age, sex and activity level						
Gender/activity level	**Male/sedentary**	**Male/ moderate**	**Male/ active**	**Female/ sedentary**	**Female/ moderate**	**Female /active**
Age (years)						
5	1,200	1,400	1,600	1,200	1,400	1,600
6	1,400	1,600	1,800	1,200	1,400	1,600
7	1,400	1,600	1,800	1,200	1,600	1,800
8	1,400	1,600	2,000	1,400	1,600	1,800
9	1,600	1,800	2,000	1,400	1,600	1,800
10	1,600	1,800	2,200	1,400	1,800	2,000
11	1,800	2,000	2,200	1,600	1,800	2,000
12	1,800	2,200	2,400	1,600	2,000	2,200
13	2,000	2,200	2,600	1,600	2,000	2,200
14	2,000	2,400	2,800	1,800	2,000	2,400
15	2,200	2,600	3,000	1,800	2,000	2,400
16	2,400	2,800	3,200	1,800	2,000	2,400
17	2,400	2,800	3,200	1,800	2,000	2,400
18	2,400	2,800	3,200	1,800	2,000	2,400
19–20	2,600	2,800	3,000	2,000	2,200	2,400
21–25	2,400	2,800	3,000	2,000	2,200	2,400
26–30	2,400	2,600	3,000	1,800	2,000	2,400
31–35	2,400	2,600	3,000	1,800	2,000	2,200
36–40	2,400	2,600	2,800	1,800	2,000	2,200
41–45	2,200	2,600	2,800	1,800	2,000	2,200
46–50	2,200	2,400	2,800	1,800	2,000	2,200
51–55	2,200	2,400	2,800	1,600	1,800	2,200
56–60	2,200	2,400	2,600	1,600	1,800	2,200
61–65	2,000	2,400	2,600	1,600	1,800	2,000
66–70	2,000	2,200	2,600	1,600	1,800	2,000
71–75	2,000	2,200	2,600	1,600	1,800	2,000
76+	2,000	2,200	2,400	1,600	1,800	2,000
USDA	www.dietaryguidelines.gov				[retr Jun 30, 2010]	

Whenever calories 'in' begin to exceed the calories 'out', a process of increased body weight is set in motion. And this is what is happening today at an epidemic magnitude.

But why are we faced with this scourge of obesity today?

Both genetic and environmental factors have been implicated in the escalation of overweight and obesity.

Genetic factors are those which are inherited from parents and which engender a predisposition to gain weight. Whether they are an inevitable determinant for weight gain or only an influencing factor is a contentious issue in the scientific community.

R.J. Loos & C. Bouchard of the Human Genomics Laboratory in Baton Rouge, USA, aver "that the currently available evidence suggests four levels of genetic determination of obesity: genetic obesity, strong genetic predisposition, slight genetic predisposition, and genetically resistant. This growing body of research may help in the development of anti-obesity agents and perhaps genetic tests to predict the risk for obesity." [*Obesity – is it a genetic disorder?*, J. Intern Med. 2003 Nov;254(5):401-25].

A strikingly different view is expressed by scientists from the Medical Research Council's Epidemiology Unit in Cambridge, U.K., reports Stephen Adams in *The Telegraph* (1 September 2010). According to the article, *Genetic excuse for obesity 'is a myth'*, researchers analyzed genes of 20,000 men and women (ages 39-79 years) and "found that people could work off around 40 per cent of the extra weight that "fat genes" laid on them by exercising." They concluded that "an active

lifestyle could go a long way to countering a person's genetic inheritance" and "even those who have the highest risk of obesity from their genes can improve health by taking some form of physical activity".

This result targeting obesity seems to be in line with other ailments where a genetic expression for disease is not inevitable. For instance, Gina Kolata queries in a news capsule: "Is genetics destiny when it comes to heart disease?" and citing Massachusetts General Hopital Center for Human Genetic Research director Dr. Sekar Kathiresan's paper in the *New England Journal of Medicine*, answers: "A new analysis of data from more than 55,000 people provides an answer. It finds that by living right — by not smoking, by exercising moderately and by eating a healthy diet heavy in fruits, vegetables and grains — people can tamp down even the worst genetic risk [of heart disease]." [http://www.nytimes.com/2016/11/14/health/genetic-heart-disease-risk-eased-by-healthy-habits-study-finds.html?_r=0]

Newer studies, however, demonstrate that calories-in and calories-out model from food and physical activity respectively may be too simplistic in today's context. The chart on the following page depicts the multiple factors that may be implicated in the globesity epidemic. A glance at the chart makes it fairly obvious that the explosion in obesity has been a rational consequence of changes in the norms of society and human behavior.

Two of the most important causes for overweight and obesity, are highly-processed energy dense foods, and sedentary lifestyle. Both are of recent origin and despite availability of copious information and its wide-

spread dissemination about the danger of both, why is it that we, as citizens of a supposedly enlightened age, persist in consuming the one, and indulging in the other?

"… Human infants .. don't arrive with a lot of built-in, instinctive behavior... Complex human behavior is not instinctive at all... Every human society expends tremendous time and energy teaching its children the right way to behave... Because complex animals can evolve their behavior rapidly. Changes can occur very quickly. Human beings are transforming the planet... behavioral processes can happen faster than we usually think evolution occurs. In ten thousand years human beings have gone from hunting to farming to cities to cyberspace... If you map complete systems on a fitness landscape, you find the behavior can move so fast that fitness can drop precipitously... My idea was that dinosaurs – being complex creatures – might have undergone some of *these behavioral changes. And that led to their extinction* [italicized for emphasis]."

– Ian Malcolm in *The Lost World* by Michael Crichton

Since both of these, energy dense diet & lack of physical activity, are behavioral traits, a somewhat in-depth historical perspective of induced behavior will not be remiss. This section focuses attention on the reasons behind the dramatic changes initiated in the United States of America, role model *par excellence*, which are becoming entrenched in all regions of the globe.

Fortuitously for the vested interests, and unfortunately for the common man, four events that escalated the scourge of overweight and obesity epidemic took place almost synchronously after the second world war in the vastly prosperous United States.

1. Obesity and Nutrition

a. Energy-dense foods- poor diet and obesity

"There is convincing evidence that a high intake of energy-dense foods promotes weight gain. In high-income countries (and increasingly in low income countries) these energy-dense foods are not only highly processed (low NSP [non-starch polysaccharides; i.e. low dietary fiber]) but also micronutrient-poor, further diminishing their nutritional value. Energy-dense foods tend to be high in fat (e.g. butter, oils, fried foods), sugars or starch, while energy-dilute foods have a high water content (e.g. fruits and vegetables). Several trials have covertly manipulated the fat content and the energy density of diets, the results of which support the view that so-called "passive over consumption" of total energy occurs when the energy density of the diet is high..."

– United Nations FAO Corporate Document Report
[http://www.fao.org/docrep/005/AC911E/ac911e07.htm]

As transportation began to be predominantly auto-driven in the 1950s, a revolution in the types and location of food availability started to change in the United States. In the post II World-War era, the food industry spawned a comparatively new genre of fast-food chains. From their humble beginning, many in the 1950s and 1960s, the fast-food restaurants mushroomed to an enormous

Fast-food chain	Starting year	1978 (A1)	2013 (A2)
McDonald's	1953	4,900	14,157
Burger King	1954	2,53	7,183
KFC	1952	5,200	4,618
Wendy's	1969	1,300	6,186
Pizza Hut	1958	3,438	7,756

presence. According to the estimates of the U.S. Department of Commerce, 60,000 mostly fast-food outlets of nationwide chains in 1978 escalated to 122,042 in 2012. For example, a few of the lead players' year of beginning, the number of restaurants of each in 1978 and 2013 are given in the table above.

Until about 1960, Americans spent almost 3/4th of their money on foods eaten at home. Beginning in the 1960s, however, the spiral of increasing incidence of eating-out commenced to be ingrained in the U.S. psyche. As the following table shows, this trend seems to be continuing and in 2014 more than half the food money

Year	Food at home (% dollar spent)	Food away from home (% dollar spent)
1950	73.65	26.35
1960	73.73	26.27
1970	66.59	33.41
1978	61.47	38.53
1990	56.99	53.01
1998	53.81	46.19
2014	49.88	50.12

Adapted from https://www.ers.usda.gov/data-products/food-expenditures/food-expenditures/#Food%20Expenditures

was spent away from home.

As fast-food eateries proliferated, recurrent visits to them by people also boomed. Fast service, uniformity of the fare across the country, cleanliness, comparative inexpensiveness of limited menu items, and ubiquitous marketing techniques, all helped in escalating sales of fast foods. "The U.S. Department of Commerce estimates that the franchise segment of the restaurant

industry ... will account for $20 billion in sales in 1978." McDonald's alone spent US$175 million, "ahead of such industrial giants as Mobil, Chrysler, and RCA", in advertisement of its products. [http://library.cqpress.com/cqresearcher/document.php?id=cqresrre1978120800]

A recent study with 1,000 adults brought out the fact that the average American now (2014) spends more than US$1,200 per year on fast-foods, with burgers, pizza and fried chicken being the most common meal items. [http://www.dailymail.co.uk/news/article-2617493/]

What is especially noteworthy is the boost in fast-food spending compared to other eat-out meals, from 21% to 52% !

Per capita expenditure in 2014 dollars

Year	Eat-out	Eat-out Fast food	Fast food as a fraction of Eat-out
1978	1580.46	326.78	21%
2014	2296.06	1200.00	52%

Calculated from https://www.ers.usda.gov/data-products/food-expenditures/food-expenditures/#Food%20Expenditures; and, cqpress.com; referenced above

Fast-foods are prepared and served in restaurants on an 'assembly line' pattern, a gift (sic) of the Industrial Revolution, for speed and high turn over. They require little training in culinary art and employ workers on minimum wage. Highly pre-processed ingredients, significantly deficient in natural nutrients but with longer shelf life, engender the convenience of quick preparation of uniformly cloned meals.

But, fast-foods are not sold in restaurants alone. Keeping pace with eat-outs is a burgeoning plethora of

highly-processed foods for the home market. From morning cereal to so-called TV dinners with innumerable titbits available for snacking at all hours of the day and night, tens of thousands of items are sold from tinned to frozen foods. They all have one thing in common – convenience. And America, where it all started, and the rest of the world gobble them up.

Increasing automation and widespread mechanized transport also helped the fast-food chains. With mass production, standardization and speedy delivery from coast to coast, the cost of ingredients plummeted and gross margins became huge. Informed sources estimate that basic ingredients of fast-foods can cost 5% or even less of the retail price of the finished product. As an example, it was estimated that a farmer gets merely 2 pennies for the potatoes used in a large order of french fries priced at $1.50 in an American restaurant. Huge margins mean that a phenomenally large amount can be spent on promotion for consumption of highly processed-foods and beverages.

So what is wrong with fast-foods?

Well, Neal D Barnard MD, adjunct associate professor of medicine at George Washington University School of Medicine and Health Sciences and president of the Physicians Committee for Responsible Medicine(PCRM) in Washington, D.C., presented a paper entitled ‘Trends in food availability, 1909-2007’ at the symposium entitled “National Conference on Childhood Obesity,” held in Washington, DC, on June 18-19, 2009, which dealt especially with intake of food-types

and obesity. Citing extensive references, he averred that "although some may be tempted to blame our girth on sloth, some studies show that a lack of exercise has played virtually no role in the *recent rise in obesity* [italics added]. The obesity epidemic and the ill health that has come along with it have been fueled by unhealthful food..."

Let us recollect that about 6% children aged 2-19 and 15% adults were obese in the early 1970s. In 2007-2008, obesity had escalated to 10%, 18%, 20% in children aged 2-5, 6-11, 12-19 years respectively and to 34% in adults. [USDA & UDDHHS *Dietary Guidelines for Americans 2010*]. A new study confirms that over a twenty year period, average American adult has actually become

	1994	2011-14
Average weight, Men (Lbs.)	181	196
Average weight, Women (Lbs.)	152	169

http://www.vox.com/2016/8/31/12368246/charts-explain-obesity

heavier by 15-17 pounds.

Data in the table above and in the preceding section fairly points to a positive relationship between the growth of fast-foods and the escalation in obesity.

There are many reasons as to why highly processed foods and beverages are not good for us. With their intentionally formulated qualities of tastiness, convenience, and addiction-stimulation from selectively developed ingredients, highly processed foods tempt us to consume them. And they make us eat more and work less.

Eat more

The operative word in processed foods is to make them tasty and addictive. What kind of nutrition or nutrients they provide is a secondary consideration.

The body breaks down ingested food to basic molecules and then assembles from these molecules those larger compounds or components – enzymes, hormones, proteins, nucleic acids, various cells & tissues – that it needs. Excessive processing radically alters the ratio of the naturally present nutrients and micronutrients in the foods. This imbalance results in fewer than required final products due to the shortage of some of the key constituent molecules.

To understand this deficiency, consider a simple example: construction of a 4-stump table. If we have 11 stumps and 4 flat tops, only 2 functional tables will be made. Thus, due to a smaller than required ratio of micronutrients needed for the optimal functioning of the enzymes required to carry out chemical reactions, many processes will not achieve completion and there will be a shortfall in the yield of the final products.

What is the body's response?

The body sends a message to the brain that it is hungry. It cannot specifically articulate that it is short of this or that nutrient or micronutrient. We generally respond to the signal of hunger by stuffing ourselves with the foods or beverages we prefer, and the spiral leads to overweight and obesity.

Fast foods are highly-processed foods. The processing of foods, in general, lowers the percentage of water and more or less removes the dietary fiber from food

items thereby increasing energy density of the foods, sometimes drastically. Fast-foods are therefore also known as energy dense foods.

Can you explain the concept of energy density?

Energy density (ED) is defined as the number of food calories (kcals) per gram (1 oz=28 g) of food item.

ED calculation is very simple. Just divide the intrinsic calories of the food by its weight in grams. That is:

Energy Density = No. of calories /Weight in grams

Several examples of ED for foods are given below:

The disparity in energy density as a function of the proportion of water can readily be seen from the table. In particular: breakfast cereal CHEERIOS, croutons, and popcorn with scant 3%,4%,4% of water respectively have a significantly higher energy density of 3.67, 4.65,

Food item	**Wt.** (g)	**water** (%)	**fiber** (g)	**energy** (kcal)	**ED**
Bread white untoasted	25	37	0.6	67	2.68
Bread whole wheat untoasted	28	38	1.9	69	2.46
Breakfast cereal Cheerios	30	3	2.6	110	3.67
Chicken fried light meat	85	60	0	163	1.92
Croutons, seasoned	40	4	2	186	4.65
Fish fillet, battered/breaded	91	54	0.5	211	2.32
Mushrooms cooked drained pieces	156	91	3.4	42	0.27
Peas, split, dry, cooked	196	69	16.3	231	1.18
Pizza slice meat & vegetables	79	48	NA	184	2.33
Popcorn, air popped, unsalted	8	4	1.2	31	3.88
Tofu, firm	81	84	0.3	62	0.77
Tomatoes raw chopped/sliced	180	94	2	38	0.21

Adapted from *Nutritive Value of Foods* USDA hg_2002.pdf

and 3.88. But removal of water and fiber is not the only cause of the high levels of ED. Supplemental amounts of fat and sugar to improve taste & texture, preservation, etc. are important contributory factors in any number of items. Mayo Clinic health professionals warn, that "... solid fats and added sugars — called SoFAS — make up a whopping 35 percent of total calories in a typical American diet. When you get so many calories from foods containing SoFAS, it's a sign that you aren't eating healthy foods that contain dietary fiber and essential vitamins and minerals. Chances are that you're also getting too many calories, contributing to excess weight and obesity."

Can you give an example of high processing of food as a cause of boosting innate calories?

America's favorite food, hamburger, with side dishes like french-fries or onion rings is chock-full of calories. Even the dietitians tend to underestimate its calorific value. Two hundred dietitians opined that a restaurant serving of hamburger and onion rings contained 863 calories, and a tuna salad had 374 calories. It turned out that those two meals had a whopping amount of 1,550 and 720 calories respectively! [Food Habits USDA 1998.pdf]

A glaring example of high-processing of food engendering a boost in calories is items prepared from potatoes.

According to the Economic Reseach Service of the USDA, per capita consumption of potatoes has remained nearly the same over the past several decades. Americans consumed 125 lbs (56.7 kg) of potatoes in 1960 and 128 lbs (58.1 kg) in the years 2000s.

What has drastically changed over the years is the proportion of potato products consumed. Back in 1960, two thirds of potatoes were consumed in their fresh state

Item ---------- Year	Total lbs (kg)	Fresh lbs (kg)	French Fries lbs (kg)	Potato Chips lbs (kg)	Dehydr ated lbs (kg)
1960	125 (56.7) 100%	81 (36.7) 65%	28 (12.7) 22%	9 (4.1) 7%	7 (3.2) 6%
in 2000s	128 (58.1) 100%	42 (19.1) 33%	55 (25) 43%	17 (7.7) 13%	14 (6.4) 11%

Data adapted and approximated from: https://www.ers.usda.gov/topics/crops/vegetables-pulses/potatoes.aspx; updated Oct. 19, 2016

and the remaining one third as french fries, chips, and dehydrated products. By the 2000s, the ratio of fresh and processed preparations was completely reversed. Fresh potato consumption is now only half of the processed items instead of the double it used to be in 1960. The following table summarizes information culled from United States Department of Agriculture:

It is actually quite striking to see what a big difference just two high-processed food items derived from one vegetable can make in proliferation of the obesity epidemic. Combining figures from the above table with EDs (Energy Density) calculated with item weight and caloric value data from *Nutritive Value of foods USDA hg72_2002.pdf* , the following table was constructed to highlight the impact of processing on gross calorie intake. Increase in consumption of french fries and potato chips since 1960 alone could have potentially led to a per capita weight-gain of 6.0 kg (13.23 lbs) per year

Calorie intake from potato preparations	ED (kcal/g)	During years 2000s Calorie intake (ED x wt. in kg x 1000)	1960 Calorie intake (ED x wt. in kg x 1000)	Difference in Calorie intake 2000s minus 1960 (kcals)
Potato boiled	0.87	16,167	31,929	–15,312
French fries	3.42	85,500	43,434	+42,066
Potato chips	5.43	41,811	22,263	+19,548
	Totals	143,928	97,626	+46,302

For wt. of potato items, please see preceding table.
Figures in the table calculated from data culled from:
https://www.ers.usda.gov/topics/crops/vegetables-pulses/potatoes.aspx; Nutritive Value of foods USDA hg72_2002.pdf

[From the table below: *increase* of french fries & potato chips consumption in the 2000s compared to 1960 in calories equals 46,302 kcals. Since 3500 kcals are taken to equal 1 lb. of fat in USDA reports, 46,302 kcals/ 3,500=13.23 lbs. or 6 kg !!!]

Another perspective on the repercussion of these surplus calories per year can be gained by calculating the effort needed to burn them (46,302 kcals/365 days=127 kcals per day) if one were motivated enough to preclude any weight gain. According to the present thinking in terms of MET (metabolic equivalents), to burn these 127 kcals would require 38 minutes of daily walking at 3 mph (4.8 km. per hour) for a person of 60 kg body weight [*Evidence on the impact of physical activity and its relationship to health* A report from the Chief Medical Officer U.K., 2004]. And let's not forget that this amount of effort is just to burn off *excess calorie intake since 1960* from increased consumption of two highly-processed items

from one vegetable alone !!!

This analysis of highly-processed high energy dense items derived from potato confirms what other studies have concluded: "high energy-dense diet is associated with greater odds of excess adiposity during childhood"; "High-energy diets with limited nutrient density seem to favor the synthesis of adipose tissue, resulting in increased accumulation of fat rather than muscle tissue and bone mass" [www.cdph.ca.gov/.../Strats4ConsumptionofEnergyDenseFoods.pdf; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4517043/], etc.

In an aside, it may be worth mentioning that french fries and potato chips have been implicated as cancer risks also. "Foods such as french fries and potato chips seem to have the highest levels of acrylamide", formed during their processing and cooking. "Storing potatoes in the refrigerator can result in increased acrylamide during cooking", that is, cooking of *frozen* french fries leads to even higher levels of acrylamide. Based on studies in lab animals, acrylamide is "likely to be carcinogenic [cancer causing] to humans" according to World Health Organization. National Toxicology Program and the Environmental Protection Agency of the U.S. Government also warn of a probable cancer risk to humans from acrylamide. [American Cancer Society; https://www.cancer.org/cancer/cancer-causes/acrylamide.html, retr 27 Oct 2017]

Larger portions of energy-dense foods in marketplace

Not only highly processed foods are energy dense but over the past several decades many factors including competition have boosted the size of the meals served

in eat-outs. The following table gives the 'average restaurant meal size' in 1950 and 2015:

"The trend toward larger portion sizes has occurred in parallel with other increases—in the availability of

Serving Size		
	1950	2015
French fries	2.4 oz.(67 g)	6.7 oz. (188 g)
Burger	3.9 oz. (109 g)	12 oz. (336 g)
Soda	7 oz. (210 mL)	42 oz. (1260 mL)

Adapterd from, http://www.vox.com/2016/8/31/12368246/charts-explain-obesity

energy in the US food supply, in dietary intake of energy, and in the prevalence of overweight and obesity" suggesting a high probability of a causal relationship since "a recent survey reports that Americans tend to ignore serving size when they are attempting to maintain body weight" report Lisa Young & Marion Nestle of New York University [*The Contribution of Expanding Portion Sizes to the US Obesity Epidemic*, Am.J.Public Health 2002 February, 92(2): 246-249].

And then there are ultra-processed foods!

A growing number of studies globally have "concluded that a high intake of added sugars increases the risk of weight gain, excess body weight and obesity..." Researchers from Sao Paolo, Brazil and Tuft University, Boston, reported in a recent paper that of the average 2,070 kcal daily intake of energy in 2009-2010, 58% (1,200 kcal) in the American diet came from ultra-processed foods: frozen pizzas, breakfast cereals, soda, breads, cakes, cookies, pies and salty snacks. Ultra-processed foods were categorized as "formulations of several ingredients which, besides salt, sugar, oils and fats,

include food substances not used in culinary preparations, in particular, flavours, colours, sweeteners, emulsifiers and other additives used to imitate sensorial qualities of unprocessed or minimally processed foods and their culinary preparations or to disguise undesirable qualities of the final product." These ultra-processed foods accounted for 262 kcal of the 292 kcal consumed from added sugars in the U.S. diet. [Ultra-processed foods and added sugars in the US diet: evidence from a nationally representative cross-sectional study, BMJ Open Volume 6, Issue 3; online 9 March 2016].

The point to be especially noted here is that most of these food items are eat-home foods. Which means that not only eat-outs are chock-full of energy dense foods but a significant portion of eat-at-home meals and snacks is also adding to the increase in weight-gain.

Has low-fat advocacy led to weight-gain? Whole vs. low fat/skimmed milk and dairy products

Medcor, Inc., healthcare service provider, of Illinois with service locations in USA & Canada in a blog entitled "Are you drinking skim to slim down? Think again–consider pouring whole milk instead!" highlights newer clinical studies that "dairy fat isn't the dietary demon we've been led to believe it is." A study involving 1,782 men over a period of 12 years by researchers from Sweden surprisingly "found that those who consumed high-fat milk, butter and cream were significantly less likely to become obese … compared with men who never or rarely ate high-fat dairy." A meta-analysis of 16 observational studies published in Europe also came to a similar conclusion: "that in most of the studies, high-

fat dairy was associated with a lower risk of obesity." These rather unanticipated findings are difficult to explain, but Medcor speculates that whole fat dairy by giving a fullness feeling may reduce food intake, or perhaps "bioactive substances in milk fat .. alter metabolism in a way that helps us utilize the fat and burn it for energy, rather than storage." [https://www.medcor.com/are-you-drinking-drinking-skim-to-slim-down-think-again-consider-pouring-whole-milk-instead/; Holmberg S, Thelin A. High dairy fat intake related to less central obesity: a male cohort study with 12 years' follow-up. Scand J Prim Health Care. 2013 Jun;31(2):89-94; Katz M, et al. The relationship between high-fat dairy consumption and obesity, cardiovascular, and metabolic disease. Eur J Nutr. 2013 Feb;52(1):1-24]

Although "advice to substitute vegetable oils rich in polyunsaturated fatty acids (PUFAs) for animal fats rich in saturated fatty acids (SFAs) has been a cornerstone of worldwide dietary guidelines for the past half century", (American Heart Association, *Journal of American Medical Association* 1961;175:389-*91),* recommendations for a low-fat diet by the U.S. Government's Guidelines perhaps originated from a study, the 'Minnesota Coronary Experiment', conducted during 1968-1973 with central focus on the amount of cholesterol circulating in the blood. The theory was that lowering cholesterol will enhance heart-health and diminish the risk of heart attacks. Consumption of skim/1% dairy did in fact lower serum cholesterol levels, and that led to the condemnation of saturated fats (for example, in whole milk). Unfortunately, whether through bias or oversight, complete results were not published. The ignored data consisted of the alarming detail that as a matter of fact "Patients who lowered their cholesterol,

presumably because of the special diet (less saturated fat, more vegetable oils), actually suffered more heart-related deaths than those who did not" wrote Peter Whoriskey in a news capsule referring to overlooked data of the Minnesota study. [https://www.washingtonpost.com/news/wonk stud./wp/2016/04/12/this-stud..]

Aaron E. Carroll, professor of pediatrics at Indiana University School of Medicine bolsters conclusions of the above study: "This isn't the first time that data from long ago have run against current recommendations. In 2013, an analysis [C.E. Ramsden and co-investigators, BMJ 2013;346:e8707] was published of recovered data from the Sydney Diet Heart Study, a randomized controlled trial of a similar nature performed in men with a recent heart attack or angina. Although the study was done from 1966 to 1973, results weren't available publicly until three years ago. It, too, found that a diet higher in unsaturated fats led to a higher rate of death from heart disease." [https://www.nytimes.com/2016/04/16/upshot/a-study-on-fats-that-doesnt-fit-the-story-line.html]

In context of obesity, studies over the past decades have also shown a link between low fat dairy and weight gain. The farmers have been feeding skim milk to fatten the pigs ever since the publication of Oregon State Agricultural College's 1930 report *Fattening Pigs for Market* proclaimed that skim milk is "not only the very best supplement for growing pigs, but is of almost equal value for fattening purposes." [http://www.wellfedhomestead.com/how-to-fatten-pigs-and-people].

Given the observation that "Overweight or obese preschoolers are *5 times* [italics added] more likely than

normal-weight children to be overweight or obese as adults" [Obesity.org], and the recommendations of the American Academy of Pediatrics & American Heart Association that "all children drink low fat or skimmed milk after the age of 2 to reduce their saturated fat intake and ward of excess weight gain", University of Virginia School of Medicine & Columbia University School of Public Health researchers carried out a study to compare the effect of varying proportions of saturated fat in milk consumed by pre-school age children. Not only was the "average weight of children who drank 2% or full fat milk" lower than the kids "who drank skimmed/ semi-skimmed milk", but it was also found that normal weight children at age 2 who drank skimmed/semi-skimmed milk were "57% more likely to become so [heavier weight] by the age of 4." [Rebecca J Scharf, Ryan T Demmer, Mark D DeBoer, **Longitudinal evaluation of milk type consumed and weight status in preschoolers.** *Archives of Disease in Childhood*; http://dx.doi.org/10.1136/archdischild-2012-302941]

Conclusion: It is evident from these studies that it is high time to substitute recommendations of low fat milk and milk products by whole milk & dairy products forthwith [Note: Americans derive about 35% of nutritional calories from dairy and dairy products] to fight globesity.

b. Soft Drinks and obesity

As incidence of globesity escalates, health professionals are frantically searching for the risk factors associated with weight-gain and obesity. Under the epithet of 'highly processed foods', soft drinks probably occupy a place of distinction for their potential ability to induce deposit of fat in most individuals. 'Soft drink' is a general term for any beverage made up of water flavored with chemicals or natural products, and sweetened with sugar or sugar substitutes, such as cola & other soda drinks, fruit punch, sport & energy drinks, etc.

In USA where incidence of overweight and obesity increased respectively from 47% & 15% in the late 1970s to 66% & 33% in 2005-2006, the consumption of calories from sugar sweetened beverages (SSB) also escalated from 3.9% in 1970's to 9.2% in 2001 with an average calorie intake of 172 & 175 kcal by children and adults respectively. One of the more telling studies of a correlation of soft-drink consumption to weight-gain involved 50,000 nurses over two 4-year time periods (1991-1995; 1995-1999). After adjusting for other potential factors, it was found that ", women who increased their SSB consumption from 1991 to 1995 and maintained a high level (1 serv/d) of intake during 1995–1999 (low-high-high) gained on average 8.0 kg over the two time periods while women who decreased SSB intake between 1991 and 1995 and maintained a low level (1 serv/wk) of intake (high-low-low) gained on average 2.8 kg." Many studies have also shown that higher consumption of SSBs in childhood and adolescence leads

to a bigger risk factor of weight-gain in adulthood. [Sugar-sweetened beverages and risk of obesity and type 2 diabetes: Epidemiologic evidence, Frank B. Hu, and Vasanti S. Malik, Physiol Behav. 2010 Apr 26; 100(1): 47–54; and references cited therein]

Health professionals from University of California San Francisco Medical Center in context of childhood obesity warn that "even if a child only has one soda [about 150 kcal] a day, it leads to 15.6 pounds (7.1 kilograms) of weight a year." Substituting fruit juice for soda is not as good an option as people may believe. "It's much healthier to eat the fruit rather than drink the juice. For example, a 12-ounce glass of orange juice, which is the juice of two to three oranges, has about 180 calories, while one orange contains only 80 or 90 calories (and for older children, it does more to make them feel full)", continues the sane advice. [https://www.ucsfbenioffchildrens.org/education/sweet_drinks_and_obesity/; retrieved 29 July 2017]

Dr. Walter Willett, chair of the Dept. of Nutrition at Harvard School of Public Health and an eminent expert on obesity also asserts a causative link of SSBs to weight-gain and affirms that "There is abundant evidence that the huge increase in soda consumption in the past 40 years is the most important single factor behind America's obesity epidemic." [https://www.hsph.harvard.edu/nutritionsource/healthy-drinks/beverages-public-health-concerns/; accessed 31 July 2017]

Soft drink consumption as a link to globesity

A team of researchers from Stanford University, USA, London School of Hygiene and Tropical Medicine, World Health Organization, Geneva and Cambridge

University, U.K. carried out a study "to test the hypothesis that soft drink consumption was related to population-level rates of overweight, obesity and diabetes" with data collected from 75 countries. Published data indicated that per capita global soft drink consumption escalated from 9.5 gallons (36.1 liters) in 1997 to 11.4 gallons (43.3 liters) in 2010. Probing for a relationship of this increase with the latest figures available for overweight and obesity in the global sample, the authors discovered that each 1% rise in soft drink consumption led to "an additional 4.8 overweight adults per 100… [and] 2.3 obese adults per 100. These findings remained robust in low- and middle-income countries." The authors found that "soft drink consumption was strongly and positively correlated with the prevalence of overweight… and obese adults", and that "within the global sample… 5.9 gallons [22.4 liters] per person per year corresponded to a 38% overweight and a 12% obesity prevalence, whereas consumption [of] 16 gallons [60.8 liters] per person per year corresponded to a 50% overweight and a 17% obesity prevalence." The authors conclude with the angst-ridden remark that "the continued rise of soft drink consumption [projected at 9.5% over the next 5 years and resulting in 2.3 billion overweight people worldwide] poses a global public health risk of worsening obesity and diabetes." [*Relationship of Soft Drink Consumption to Global Overweight, Obesity, and Diabetes: A Cross-National Analysis of 75 Countries*, Sanjay Basu, Martin McKee, Gauden Galea, and David Stuckler; *Am J Public Health*. 2013 November; 103(11): 2071–2077; and references cited therein]

And how truly shocking the repercussion of

'globesity' epidemic is was pinpointed by a team of researchers from Global Burden of Diseases Nutrition and Chronic Diseases Expert Group (a consortium of Tufts University, Harvard School of Public Health, University of Washington and Imperial College London) reported in an exhaustive study estimates of deaths attributable to consumption of SSBs. The authors developed a comparative risk assessment model incorporating data from diverse sources of 187 countries on effects of SSBs on weight-gain and the impact of this fatness on the burden of chronic maladies. Final estimates revealed that SSB consumption could account for 184,000 fatalities: 133,000 deaths due to diabetes, 45,000 deaths from CVD, and 6450 from cancer, as well as for 8.5 million disability-adjusted life-years worldwide. Since the younger generation's consumption of SSBs is higher in most countries, the authors reached the distressful conclusion that "future health burdens could be even higher as younger populations age." [*Estimated Global, Regional, and National Disease Burdens Related to Sugar-Sweetened Beverage Consumption in 2010*, Gitanjali M. Singh, Renata Micha, Shahab Khatibzadeh, Stephen Lim, Majid Ezzati, Dariush Mozaffarian, *Circulation*. 2015;132:639-666]

It is also unfortunate that intake of soft drinks instead of satisfying the need for calories, gives impetus to a craving for additional soft drink or sweets consumption.

How do sweetened beverages incite further consumption of sweets?

Studies have shown that when people eat a bigger than usual meal with higher intake of calories, they generally tend to compensate by reducing the amount of

food in a subsequent meal. That, however, is not observed to be the case with soft drinks. It seems that soft drinks do not provide the same sense of 'fullness' that solid foods do or, the soft drink fullness lasts a shorter time. It also means that soft drinks can be piled up as an adjunct to the meals with addition of extra calories. There is also the likelihood that **sweetened beverages** stimulate craving for more sweet foods or drinks perhaps by the following process.

Energy is generated in our bodies through breakdown of nutrients by enzymes. **Simple** and **complex carbohydrates** are the preferred sources of energy generation. Simple carbohydrates are one, or two molecules (scientific term for units) of **glucose** or glucose like substances joined together, such as **table** or **corn sugar**, or sugar from **fruits** or **dairy**. Complex carbohydrates are hundreds and thousands of glucose or glucose like units bonded together to form long chains known as **starches** which are present in **grains**, **legumes** and **starchy vegetables**. All convertible carbohydrates are changed in to glucose molecules and assimilated in to our blood stream. This circulating glucose is generally referred to as '**blood sugar**'.

Insulin, a hormone, secreted by **beta cells** of the **pancreas**, makes it possible for **blood glucose** molecules to penetrate in to the cells of the body where they get broken down to release energy. Surplus glucose gets stored in muscles and liver as a derivative of glucose called **glycogen**, or in the skin as fat tissue.

Many body functions continue even at rest. A small **basal amount** of **insulin**, therefore, keeps circulating in the blood for helping glucose to enter cells and generate

energy for ongoing life processes. After a meal, insulin production is boosted up to facilitate the diffusion of increased amounts of glucose in to the cells. **Food starches** break down slowly and the freed glucose molecules are gradullyly added to the blood stream which get mopped up by cells through basal levels of insulin production.

Simple sugars in **sweetened beverages**, however, require little manipulation and are broken down to glucose molecules almost instantaneously and begin circulating in the blood stream. The sudden increase of sugar, as for instance from a can of soda, triggers a hasty signal to **pancreas** to boost up the production of insulin. In the ensuing high gear production, more than actually needed insulin gets produced, effectively causing blood sugar in the mop up process to fall below the **basal level**.

This drop in basal level of blood sugar generates a craving for more sweetened products, consumption of which requires another bout of insulin production. And this roller-coaster of blood sugar usually fosters an insatiable craving for soft drinks. As the well-known journalist and author, E.J. Cahn wrote in *The Big Drink*:

> "You can drink Coke every day all day long and not get tired of it. Fifteen minutes after you've finished a Coke, you're a new customer again …"

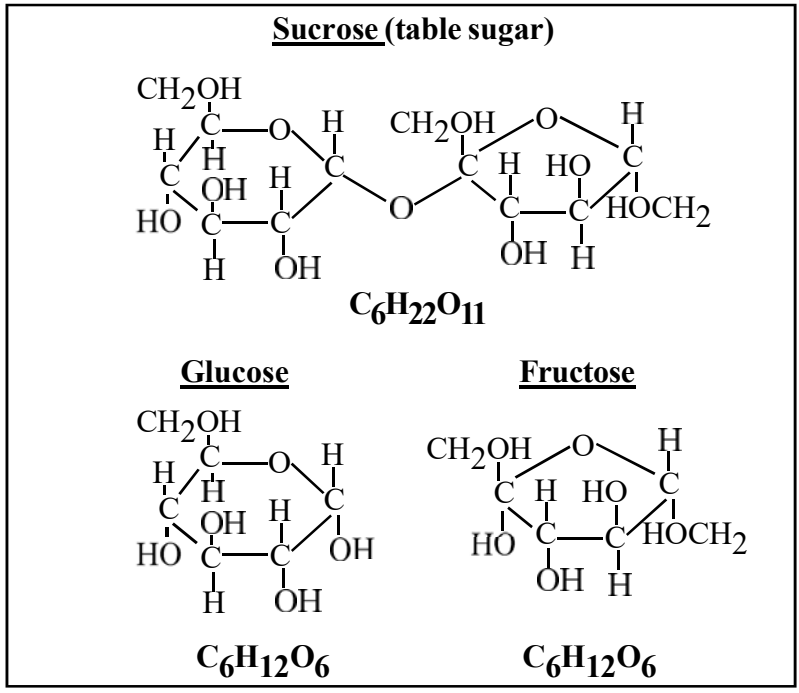
High speed production of insulin naturally stresses out the pancreas. If it is only an occasional event, the body copes with the stress with its natural aplomb and no permanent damage is done. But a continual demand for excessive production of insulin is likely to damage the pancreas.

"Repeated surges in blood sugar make the pancreas

work harder and can contribute to insulin resistance, thereby increasing the risk for **Type 2 diabetes**" asserts Dr. David Ludwig, director of New Balance Foundation Obesity Prevention Center at Boston's Children's Hospital. It is well known that insulin resistance is "closely linked to overweight and obesity."

The Fructose Factor

Common table sugar (sucrose), a carbohydrate (compounds formed from carbon, hydrogen, and oxygen), consists of one molecule of glucose and one of fructose. Up until the early 20th century, Americans consumed about 15 grams (slightly over half oz.) of fructose mostly from fruits and vegetables. By the early 21st century fructose consumption increased to about



70 grams. Almost all of it comes from added sugars in liquids and foods.

In the late 1960's, corn starch, which contains large chains of glucose units, was converted to 90% or more fructose by employing enzymatic manipulations. This high fructose corn syrup (HFCS-90) was much sweeter than sucrose (1.3 to 1.7 times more), and could be used to formulate various combinations of fructose-glucose mixtures. Food industry became terribly interested in HFCS because it was significantly cheaper than sucrose, in part due to substantial subsidies for the crop of corn. Since 1980 HFCS has been increasingly used in SSBs and most sweetened foods in a fructose-glucose ratio of 55-45 (HFCS-55), and in numerous other products in a ratio of 42-58 (HFCS-42), although, Michael Goran and co-workers found that "several major brands [of SSBs] appear to be produced with HFCS that is 65% fructose." [Obesity, April 2011, 19-4, pp. 868-874]. Of some 600,000 food items available in USA, HFCS is alleged to be used in almost 70% of all foods and drinks.

Geroge Bray, a professor of medicine in Louisiana and Prof. Barry Popkin of University of North Carolina in a scientific research paper published in 2004 advanced a hypothesis that consumption of higher amounts of fructose through HFCS, sales of which had skyrocketed, may be responsible for doubling of obesity in America between 1980 and early 21st century.

Ever since then fructose and HFCS, as a factor in weight-gain, have become a contentious issue among the medical and scientific community. Some researchers contend that HFCS is really not different to table sugar in its health effects, while others contend that un-

like glucose which is metabolized in the cells throughout the body, fructose is absorbed in the gut and almost entirely metabolized by the liver as is alcohol from hard-drinks intake. According to Harvard Heart Letter (September 2011), "Virtually unknown before 1980, *nonalcoholic* [itlaics added] fatty liver disease now affects up to 30% of adults in the United States and other developed countries, and between 70% and 90% of those who are obese or who have diabetes... Higher intakes of fructose are *associated* with these conditions, but clinical trials have yet to show that it *causes* them."

Reacting to the approval by European Food Safety Authority (EFSA) for replacement of table sugar & glucose by fructose in "sugar sweetened foods or beverages" for people "who wish to reduce their post-prandial glycaemic responses" [blood glucose levels after meals] because "Consumption of fructose leads to a lower blood glucose rise than consumption of sucrose or glucose", Dr. Robert Lustig, professor of pediatrics at the University of California, San Francisco, counters with "yes… it doesn't increase blood glucose. It's fructose, for goodness sake. It increases blood fructose… a 20oz. [about 600 milliliter] soda results in a serum fructose concentration of six micromolar, enough to do major arterial and pancreatic damage."

Food Industry contends that the liver makes fat from oral fructose at a very slow rate. Dr. Lustig argues that research cited by food industry involved only slim, insulin sensitive, fasting subjects given fructose alone which is absorbed poorly in any case. "If you're obese, insulin resistant, well fed, and getting both fructose and glucose together (like a sizable percentage of the population),

then fructose gets converted to fat at a much higher rate, approximating 30%", he says. And that is the reason, Dr. Lustig claims that "fructose is just as bad as alcohol in causing fat storage in the liver — and in causing fatty liver disease", vocalizing the same sentiment as the Harvard Health Letter cited above.

It is noteworthy that EFSA itself recognizes that "high intakes of fructose may lead to metabolic complications such as dyslipidaemia, insulin resistance and increased visceral adiposity." But then what is a high intake for fructose? Apparently any amount above 40-50 gram per day according to EFSA. In America, amount of fructose just from added sugar is around 70 grams and most developed countries have similar consumption. [EFSA Journal 2011;9(6):2223; Robert Lustig, *Fructose: the poison index*; https://www.theguardian.com/commentisfree/2013/oct/21/fructose-poison-sugar-industry-pseudoscience.]

National survey data for obesity in America seemingly confirms Dr. Lustig's argument. Coca-Cola and Pepsi, the two market dominating SSBs began using HFCS from 1980 and 1981, respectively.

The particular observation to note in the survey figures for adults aged 20-74 years is that the incidence of overweight has remained more or less constant from 32.7 to 31.9% during the periods, 1971-1974 to 2013-2014, as well as for the intervening years. Obesity rate has, however, jumped 263%, from 15.0% in 1976-1980 to 38.2% in 2013-2014, with extreme obesity showing a leap of 579% from 1.4% in 1976-1980 to 8.1% in 2013-2014. Mark the significant upward progression of obesity all through the intervening years. (please see tables)

A similar pattern can be seen in the overweight fig-

Prevalence of overweight and obesity (%) in United States adults 20-74 years

Survey period	Overweight	Obesity	Extreme Obesity
1971-1974	32.7	14.5	1.3
1976-1980	32.1	15.0	1.4
1988-1994	32.6	23.2	3.0
1999-2000	33.6	30.9	5.0
2009-2010	32.7	36.1	6.6
2013-2014	31.9	38.2	8.1

Prevalence of overweight and obesity (%) in United States children 2-19 years

Survey period	Overweight	Obesity
1971-1974	10.2	5.2
1976-1980	9.2	5.5
1988-1994	13.0	10.0
1999-2000	14.2	13.9
2009-2010	14.9	16.9
2013-2014	16.2	17.2

Prevalence of obesity (%) in United States children

Survey period	2-5yrs	6-11yrs	12-19 yrs
1971-1974	5.0	4.0	6.1
1976-1980	5.0	6.5	5.0
1988-1994	7.2	11.3	10.5
1999-2000	10.3	15.1	14.8
2009-2010	12.1	18.0	18.4
2013-2014	9.4	17.4	20.6

https://www.cdc.gov/nchs/data/hestat/obesity_child_13_14/obesity_child_13_14.pdf

ures for children (table above) : children aged 2-19 years show a 159% increase in overweight but a 331% jump in obesity from 1976-1980 to 2013-2014, and the intervening years show a continuous upward trend in obesity. The jump in obesity in 6-11 years old and 12-19 years old is much more pronounced, 435% and 338%, respectively.

It is now fairly well established that the liver of overweight individuals, which is already stressed, converts the incoming higher proportion of fructose from HFCS sweetener to fat (adipose tissue) to the extent of 30% as Dr. Lustig asserts. As we know, carbohydrates are the major source of energy in the human body, and experiments have shown that it requires very little extra energy to convert energy to adipose tissue. [Golden, M.H., Proposed recommended nutrient densities for moderately malnourished children, *Food Nutr. Bull*. 2009, 30, 267–342]. Therefore, to an impaired liver, conversion of onerous amounts of fructose to fat may become the preferential pathway as Dr. Joseph Mercola, citing Dr. Lustig's research at University of California San Francisco, affirms, "When you eat 120 calories of glucose, less than one calorie is stored as fat. 120 calories of fructose results in 40 calories being stored as fat." [https://www.huffingtonpost.com/dr-mercola/sugar-may-be-bad-but-this_b_463655.html; Nov 17, 2011]

Mark Hyman MD, practicing physician, founder of *UltraWellness Center* and a New York Times best-selling author, goes so far as to aver, "If you want to stay healthy, lose weight easily, get rid of chronic disease, and help reduce the obesity epidemic, the single most important thing you can do is eliminate high fructose

corn syrup from your diet and from your children's diet." [http://www.huffingtonpost.com/dr-mark-hyman/high-fructose-corn-syrup_b_4256220.html; accessed 1 Aug 2017]

Support from brain research about fructose's potential role in adiposity

A study conducted by researchers from Oregon Health & Science University, University of California Davis and United States Department of Agriculture Davis, is supportive of the link between fructose and weight-gain. Briefly the study involved 9 healthy normal weight volunteers who were infused with glucose, fructose and saline (as control), and their brain function was recorded through magnetic resonance imaging. Interpreting their novel experiment, the authors concluded that "the differences we report in brain responses to glucose and fructose infusions in these normal weight subjects are supportive of a neurological basis for the recently demonstrated effect of dietary fructose to promote weight gain in animals [in mice, who share a close relationship in genetic, biological and behavior characteristics to humans]... and a preference for consumption of higher fat foods in humans..." [J.Q. Purnell et al, *Brain functional magnetic resonance imaging response to glucose and fructose infusions in humans*, Diabetes, Obesity and Metabolism 13: 229–234, 2011].

Conclusion: From the facts described above, it seems highly likely that consumption of high proportions of fructose in combination with high amounts of added sugars may be a significant factor in the globesity epidemic.

Are diet drinks the answer to this conundrum?

For a number of years **diet drinks** were supposed

to be the rational solution to the problem of excessive calorie intake from soft drinks. As an occasional substitute or in the short run, diet drinks do limit intake of surplus calories. Recent studies, however, have thrown a damper on this simple and not too disagreeable alternative. Not only the super non-sugary sweeteners have surfaced as potential health hazards, but it now appears that diet drinks may actually incite unslakable yearning for sweets and calories. More than one study has reported that over the course of several years, diet soda drinkers gained more weight.

Purdue University researchers observed that rats on **saccharin** sweetened diet gained more weight than those that consumed sugar sweetened food. An eight year long clinical study in Texas involving 3,700 people also showed higher probability of gaining weight with consumption of diet drinks. It is alleged that **artificial sweeteners** disrupt the body's satiety mechanism. "By providing a sweet taste without any calories, artificial sweeteners could confuse… intricate feedback loops that involve the brain, stomach, nerves, and hormones" so that the body does not know how many calories were taken in and what more is needed. [http://www.hsph.harvard.edu/nutritionsource/healthy-drinks/sugary-vs-diet-drinks/[retr Oct 13,2011]

At the American Diabetic Association meeting in San Diego on June 26, 2011, Dr. Helen Hazuda of University of Texas Health Sciences Center at San Antonio, reported that "diet soda [2 or more diet sodas per day] drinkers' waist size grew 70% more than non-drinkers." But how do the diet drinks provoke weight gain if they are devoid of calories? Dr. Sharon Fowler answers the

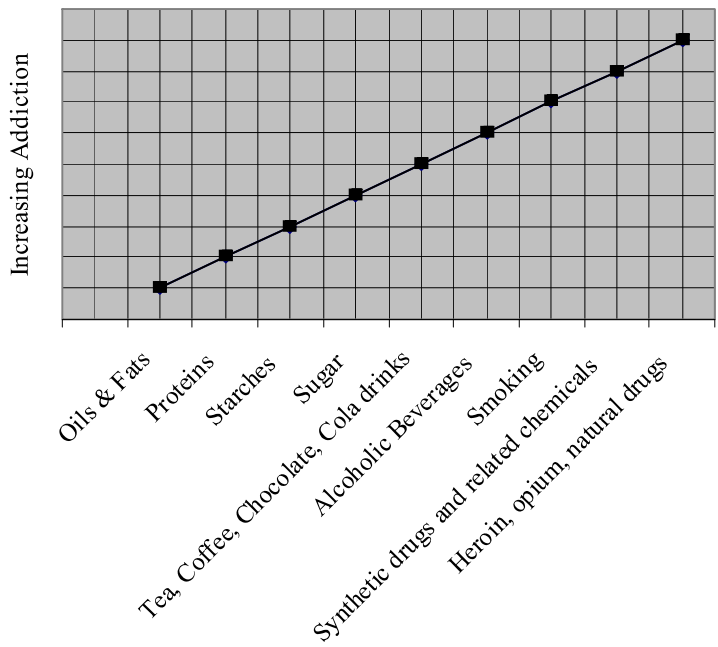
query by referring to another study conducted also at UT Health Sciences Center on mice. Mice fed the commonly used artificial sweetener aspartame laced food for 3 months had higher blood sugar than mice eating normal food. "Artificial sweeteners could have the effect of triggering appetite but unlike regular sugars they don't deliver something that will squelch the appetite," explained Dr. Fowler, and speculated that artificial "sweeteners could inhibit brain cells that make you feel full". [CBS News June 29, 2011. http://www.cbsnews.com/8301-504763_162-20075358-10391704.html]

Just as a sidelight on diet soft drinks in context other than obesity, a study carried out by Hannah Gardener at University of Miami showed that consumption of fizzy diet drinks could increase risk of heart attack & stroke. Commenting on these results, Dr. Sharlin Ahmed of The Stroke Association said, "According to this study, drinking diet fizzy drinks on a regular basis could pose the same or even higher risk for cardiovascular disease as standard fizzy drinks, providing a word of warning to those who often opt for diet versions in order to be "healthy". [MailOnline 10 Feb. 2011; http://www.dailymail.co.uk/health/article-1355264/]

And "Research on 3,000 women found that two or more artificially sweetened drinks a day doubled the risk of a faster-than-average decline in kidney function" reports MailOnline (2nd Nov. 2009) quoting a study by Boston's Brigham and Women's Hospital researchers led by Dr. Julie Lin. [http://www.dailymail.co.uk/health/article-1224610].

Do soft drinks contain caffeine? What is its role?

Oh yes, majority of soft drinks contain **caffeine**. **Coca-cola**, the grand daddy of all soft drinks, initially contained cocaine from coca leaves as well as caffeine from kola nuts. **Cocaine**, one of the most potent mind altering drugs, was dropped from its formula in the early 20th century. Tobacco, alcohol, cocaine and heroin, are formally classified as **addictive**, but controversy still persists about the addictive role of caffeine. **Dr. Theron G. Randolph**, the great allergist, said that even common foods could be mildly addictive. The problem with addiction is that it creates psychological and physiological



Addiction from Common Foods & Drugs

[Rearranged from Theron G. Randolph MD & Ralph W. Moss Ph.D., *An Alternative Approach to Allergies*, revised edition, New York: Harper & Row 1989, p 27-8]

dependence and discontinuation generally leads to bouts of discomfort. The crucial factor is, of course, the addictive power of the substance. Substances of higher addictive influence are more difficult to give up as every smoker knows. The chart shows comparative degrees of addiction for varied items from foods to narcotics.

Frequent and regular use of even a mildly harmful substance will add up the deleterious effects and can lead to serious problems over time.

Manufacturers using caffeine in soft drinks dispute that caffeine is addictive. The Coca-Cola Company maintains that "People who say they are "addicted" to caffeine tend to use the term loosely, like saying they are "addicted" to chocolate, running, shopping, working or television", and cites the World Health Organization's stand that "There is no evidence whatsoever that caffeine use has even remotely comparable physical and social consequences, which are associated with serious drugs of abuse." The Company further alleges that "caffeine is not classified as causing 'substance dependence'" in the American Psychiatric Associations' DIAGNOSTIC AND STATISTICAL MANUAL OF MENTAL DISORDERS (DSM). [http://www.thecoca-colacompany.com/ourcompany/hal_yourhealth.html [retr Oct 26, 2011]

Johns Hopkins Medicine's online version refers to a thorough review of caffeine by Drs. Roland Griffiths and Laura Julian in context of addiction. The authors reviewed 57 experimental and 9 survey studies on caffeine published over the past 170 years and "identified five clusters of common *withdrawal symptoms*: headache; fatigue or drowsiness; dysphoric mood including

depression and irritability; difficulty concentrating; and flu-like symptoms of nausea, vomiting and muscle pain or stiffness" from daily consumption of as little as 100 milligrams of caffeine.

Occurrence of withdrawal symptoms is a robust indicator of addiction. Drs. Griffiths and Julian's research additionally brought out the fact "that avoidance of caffeine withdrawal symptoms motivates regular use of caffeine." And that is perhaps what feeds the appetite for escalating consumption of soft drinks. It is expected that these results will become part of the forthcoming edition of American Psychiatric Association's DSM, as well as included in the World Health Organization's reference publication, *The International Statistical Classification of Diseases and Related Health Problems.* [Johns Hopkins Medicine, September 29, 2004; http://www.hopkinsmedicine.org/ press_releases/2004/09_29_04.html [retr Oct 23, 2011].

The reader's attention is also drawn to the fact that quantity of caffeine in soft drinks is regulated by Food & Drug Administration (FDA) of U.S. Government because of its potential for harmful effects on health. Caffeine content is limited to no more than 0.02% in soft drinks which works out to be 68 milligram per 12 ounces. "The American Academy of Pediatrics recommends that adolescents get no more than 100 mg of caffeine a day. Younger children shouldn't drink caffeinated beverages on a regular basis." [http://www.mayoclinic.com/health/caffeine/AN01211; retr Oct 22, 2011]

c. Processed foods may instigate 'move less'

Food in the ancient medical system of India, Ayurveda & yoga, is categorized in relation to its behavioral effect on human body. Highly-processed foods will fall in to the category of tamasic foods because they are old, stale, and impure in the sense of containing numerous unwanted additives and chemicals and prepared much ahead of consumption. Of the three modes, *sattva, rajas, tamas*, through which activities of Nature are carried out, the mode of *tamas* denotes darkness, negligence and inertia & indolence. Tamasic foods, hence, may instigate a disinclination to physical activity (causative factor being inertia). As indicated above, highly processed foods are energy dense and do often impart a feeling of heaviness and lethargy. This concept of varying attributes of foods is not dissimilar to what the science itself has discovered. To give one example, calories from trans and saturated fats liberally used in processed foods are reported to have a potential to increase body fat whereas mono- and polyunsaturated fats are more likely to provide energy for many essential body processes and tissues.

2. Obesity and Physical Activity

2a. Role of Automation in obesity

By the 1950s, road network in America had increased tremendously and personal transport became commonplace. Families moved farther away from places of work, school, grocery store, supermarket, and friends. People began to commute for everything. Initially, love of the car and indolence went hand in hand. Referring to the behavior of individuals in Southern California, the initiator of the first drive-in restaurant in 1921 in Texas and an early founder of a fast food chain, Jesse G. Kirby said, "People with cars are so lazy, they don't want to get out of them to eat!" But as the 1950s came around, car became the epitome of convenience and thereby grew in to a habit for short distances, and a necessity for long. The sad consequence, not fully appreciated for many years, was that routine walking for daily chores, an excellent means of habitually shedding excess calories, became practically extinct.

Numerous other household labor activities such as washing clothes & dishes, mowing lawn, washing cars, etc. were also mechanized and adapted by all families as soon as monetary resources became available. And at workplace, from factories, mills, warehouses, to construction sites – lifting, moving, paring, assembling, pounding, etc., that is, all manufacturing activities became more or less mechanized and traditional burning of calories at work suffered diminution as well.

This deficit in energy loss due to automation and mechanization is scientifically termed as non-exercise activity thermogenesis (NEAT); it comprises of all en-

ergy expenditure other than sleeping, eating, and exercise. NEAT has been estimated to be in the range of 500-1,000 calories per person per day. Given that about 3,500 calories are equal to nearly 1 pound (454 grams) of fat, this shortfall in NEAT may add up to 1-2 pounds of weight gain per week in the absence of remedial measures. [Ref.: Treatment of Obesity, *Mayo Clinic Proceedings January 2007 vol. 82 no. 1, 93-102*, and references cited therein]

2b. Role of Sports in obesity

Physical activity has been defined as "any bodily movement produced by skeletal muscles that require energy expenditure." Planned physical activities for fitness are acknowledged to consist of **sports, exercise, or gymnasium** workouts. But an overwhelming promotion of sports through **mass media**, especially **TV**, has led people to tacitly believe that the preferred physical activity for health is games & sports.

What is wrong with that? "I myself play cricket several times a week", intones a student

I think that the belief that games & sports are closely linked to health is a remnant of that era when personal motorized transport was by and large non-existent and automation was at a low key. Conditions were such that people would expend a significant amount of energy in walking for daily chores and other necessary manual tasks (See preceding section). This energy expenditure in actuality provided *the foundation* of physical fitness. *In addition* to this daily work-load, individuals who participated in programmed physical activities such as games

& sports were predictably healthier. And this gave rise to the now deep-seated belief that 'games & sports are the source of sound health' syndrome.

How deeply ingrained this notion of 'sports being the source of sound health' is, was very clearly illustrated by the following real-life incident.

In one of my talks in the summer of 2007 to a group of 100 teenagers from a State-aided Army School in India, I belittled benefits of **cricket** [practically the national game of India today] in *context of health* and depicted the actual play of the game in the following words: 3 stumps of a wicket on each side of a measured pitch. Thirteen players positioned motionless on the grounds – 2 batsmen of the batting team posturing near the wickets, 11 players of the fielding team spread out on the field. One player runs and throws a ball. A batsman hits the ball and usually 2-4 players run after it. The ball is picked up and thrown back to the bowler or the wicket-keeper. In the meantime, the batsmen may or may not run between the wickets. Then all 13 players on the field become motionless again, and the entire process is repeated. This goes on for hours together. Lots of excitement & entertainment, but little workout for most players.

One 16 year old seemed quite upset and raising his hand said he did not agree with my view. He added that he was a promising cricket player and that his school had arranged special coaching for him in the sport. He further said with jutifiable pride that he was ranked at the top in physical fitness in his School. I queried him as to what else did he do as far as physical activities were concerned. He replied that he spent 1- 2 hours every

day on workouts. Even as he was in the process of vocalizing this answer, it dawned on him, perhaps for the very first time, that that was exactly the point I had been making all along; that all superior sportspersons gain their exceptional fitness from workouts & exercise. As the other youngsters giggled, he slowly sat down, rather dazed from the disagreeable revelation that playing cricket may not have much to do with good health.

So far as fitness and health are concerned, the game of cricket could be ranked nearly at the bottom of the totem pole in any list of meritorious physical activities. But Since cricket is so unbelievably popular in India and other Commonwealth countries (which include most of Britain's erstwhile colonies), and could be a major contributor to the obesity in the younger generation, a critique of this game in terms of national performance by a noted international journalist may not be out of place here.

South Asia correspondent for the premier French newspaper *Le Figaro*, Francois Gautier, blames cricket for the pathetic performance of India in athletics, games, and sports. "One sees the energy of a nation in sports", writes Gautier and continues,"... cricket, a game which is a colonial legacy... meant to be played in cool weather... with a few spectators who shout 'jolly good' from time to time... not a game intended for a tropical country where you *stand* [Italics added] for hours under a blistering sun". He laments the fact that a vast country with a great past and greater potential is nowhere on the sports scene. Its nearest geographical neighbor with only slightly higher population, China, in barely thirty years, in the 2008 Olympics won a total of 100 medals, and over-

took the mighty USA in the tally for gold medals winning 51 to America's 36. India won 1 gold and 1 bronze.

Why is a country which gave hatha-yoga and *pranayama* (breathing exercises), 'spreading like wildfire', to the world, has such a dismal record, Gautier asks? "Because of cricket ... even the Government [of India] have concentrated so much only on cricket at the expense of all the other sports" grouses Gautier. [Francois Gautier in *Arise, O India*, New Delhi, 2000, Har-Anand Publications, pp 144-45]

Media – newspapers, magazines, radio, TV – coverage of sports typically shows the dexterity, agility, quick reflexes and excellent health of players in competitive situations, tacitly implanting the notion of a direct link between sports and health. That is actually far from the truth. What one rarely sees is the time & effort sportspersons put-in in to work-outs & exercises including jogging, running, weight lifting, brisk walking, yoga postures and *pranayama* breathing exercises, to achieve suppleness, stamina, endurance and physical fitness. A few examples of super cricketers from India will make this point clear. Rahul Dravid is said "to do a lot of aerobic exercises and yoga to remain physically as well as mentally fit." The same writeup refers to Yuvraj Singh as well. "His skill set on the field is well known, but not many people know the hard work that he puts in while being off field." Yuvraj Singh himself is quoted as saying, "My hard work *off the field* [italics added] keeps me physically fit on the field." [http://www.mensxp.com/health/body-building/2640-fitness-tips-from-top-indian-cricketers-rahul-dravid-a-yuvraj-singh.html; retr April 18, 2012]

And what of the all time great or the greatest of cricket, Sachin Tendulkar? Even though he is quoted as saying that he "firmly believes that playing cricket is the best form of fitness", he himself does "yoga, meditation, pranayama, gym and even aerobics". [http://www.nidsun.com/sachin-tendulkar%E2%80%99s-diet-secrets/][retr April 18, 2012]. But in light of the above discussion, this view of Sachin Tendulkar, that cricket is the best exercise, seems like a gimmick which people with vested interest often make in exorbitantly promoting one thing over others. Regrettably, without knowing about the substantial time Tendulkar spends in his diverse workouts, people in general and youngsters in particular, due to his enormously iconic stature as a sportsperson *par execllence,* take his words about cricket as a panacea for all needs of physical activity !

Are you contending that sports don't provide health benefits?

A.: No, not that sports are totally bereft of benefits. Their contribution to team work, discipline, self-worth, coordination, fair play, camaraderie, etc. is recognized as commendable. Sports' contribution to health, however, is generally marginal and does not provide benefits commensurate with the costs incurred in terms of time and other resources. I think it may be relevant to the thrust of this book to go in to some detail about the inadequacy of sports in the framework for health. Following discussion addresses some of these limitations.

Purpose of Sports: Whenever we want to achieve salubrious results from any activity, we should obvi-

ously be clear-cut about our target. For years in 'adventure-youth camps' conducted in the Himalayas by Sri Aurobindo Education Society of New Delhi, I used to give a slogan, 'Exercise for health, games for entertainment', to the youngsters. In process of writing this essay, I therefore searched the Internet to see what other people say and discovered that in general others also were in agreement with this view. Thus:

"A sport is a physical activity carried out under an agreed set of rules, with a *recreational purpose* [italics added]: for competition or self-enjoyment or a combination of these. A game is a recreational activity involving one or more players, defined by a goal that the players try to reach, and some set of rules to play it. Games are played primarily for entertainment or enjoyment…" opines Amit Loiwal from Dubai on 'The Times of India/ Open Space [http://timesofindia.indiatimes.com/opinions/1363091.cms. Retr. May 5, 2010].

Swagata Dey's answer was succinct, "You play "games" in order to have fun. You play "sports" to win." [http://in.answers.yahoo.com/question/index?qid=20080904060419AAZTyqr; retr. May 5, 2010].

Professor Sir Liam Donaldon, Chief Medical Officer, Department of Health of Britain, in his report *At Least Five a Week*, defines sport "as a subset of physical activity, which involves structured competitive situation governed by rules."

None of the searched websites alleged that the purpose of games and sports was acquisition or maintenance of health.

It is obvious that others also think that the primary intention behind sports is enjoyment and competition.

Sports, particularly the ones that get inordinate exposure on TV these days, are more akin to other professions which enable people to earn money, often top dollars as they say.

If our main objective is to gain excitement, fun and entertainment, why should we be surprised and dismayed in seeing the incidence of **globesity** escalate, for sports are serving their purpose; they are *not* "pursued for personal health and fitness"?

Burning of calories: Watch a game of soccer or volleyball or even basketball. Not in a high profile competitive situation but as a physical activity most often pursued in a normal everyday setting, for examples in schools, ostensibly for health. A few photographs in such a setting are presented below:

a. Please observe the small number of players who are actually in motion even when the ball is active on the court or field. If the ball goes out of field, which happens frequently enough, almost all players are at rest.

Well, of course, that is not unreasonable, since there is ONLY one ball and, by rules of the game, 10-22 players are required to chase the same solitary object !

b. Yet, highly respected institutions give calorie-burnt figures for participating in sports by weight of player and the amount of time spent. Thus, Harvard Heart Letter, Mayo Clinic and US Centers for Disease Control and Prevention (CDC) give calories burnt figures presented in the table below. [www.health.harvard.edu/newsletters/harvard_heart_letter; http://www.mayoclinic.com/health/exercise/SM00109,retr aug 29, 2011; http://www.cdc.gov/healthyweight/physical_activity/index.html; retr July 4, 2011]

Other websites like American Heart Association, National Institutes of Health, etc. give similar figures.

There are two very pertinent considerations here.

1. Many players due to their assigned position on the field and the restrictions placed on their movement (per game rules) may get lesser workout. For instance,

a goalkeeper in soccer or hockey, or wicket-keeper in cricket gets minimal exercise. Other players for strategic and/or game-plan reasons do not go beyond a certain distance on the field, and may thus be physically inactive during a significant part of the play. For instance, in an average one hour American National Football League game, a player covers some 600 yards.

2. A second factor of consequence is the skill of the player. Skilled players get a better workout than unskilled in team sports such as soccer, hockey, volleyball and basketball. The amount of calories burnt in games such as badminton, table tennis or tennis to a great extent also depend on the skill of the players. Unless one makes a determined and sustained effort to improve one's skill, more often than not, the ball or shuttle-cock is blocked by the net or goes out of court very frequently and the volley ends. Players pick up the ball or shuttle rather leisurely and start the volley again. Due to shortage of time or other constraints, majority of play-

ers never achieve real proficiency at the game; and inexpert players will naturally end up burning considerably fewer calories.

Calories burnt per 60 minutes of play			
Reference	**Player's weight**	**Sport**	**Kcal burnt**
Harvard	155 Lb.=70 Kg	Soccer	260
Mayo	160 Lb.=72 Kg	Volleyball	292
CDC	154 Lb.=70 Kg	Basketball	440

Websites or literature giving calories-burnt data do not seemingly distinguish between both the skill level and the position of players on the field. A layperson will just assume from the tables prepared by experts from recognized institutions that if s/he plays the game for the specified amount of time, the given calories were burnt [Note: Have you not heard the refrain? "Oh, I did play cricket, or soccer or volleybal for 1/2/3 hours!]. One does wonder how these figures for sports are applicable to all people merely on the basis of weight of an individual and the amount of time spent playing the game? Just imagine, a 155 pound youngster or adult, after playing at goal-keeper position for an hour in a soccer game, seriously believing and eminently satisfied that s/he had expended 260 calories !!

Harvard Heart Letter (July 2004) gives an amusing statistic. Playing 30 minutes of non-competitive volleyball burns 112 calories; pushing a cart while shopping in a supermarket for 30 minutes burns 130 calories! [http://www.health.harvard.edu/newsweek/Calories-burned-in-30-minutes-of-leisure-and-routine-activities.htm; retr Nov 2, 2011]

Injury Potential : Most information for this section, as

well as many preceding ones, refers to data from developed countries where data collection is more consistent and organized. The intent here is to draw attention to the risk of injury associated with games & sports.

According to the Centers for Disease Control and Prevention (CDC) of the United States Government, some 7 million Americans had to seek medical attention for Sports & Recreation (SR) injuries annually during 1997-99 with the highest proportion of injuries reported in 5-24 year olds [http://injuryprevention.bmj.com/cgi/content/abstract/9/2/117. Inj Prev 2003;9:117-123]. Children, adolescents, women, and middle aged people are especially vulnerable to "sports injuries: some minor, some serious, and still others that may result in lifelong medical problems. Young athletes are not small adults. Their bones, muscles, tendons, and ligaments are still growing and that makes them more prone to injury" cautions the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) of National Institutes of Health (NIH). "Because young athletes of the same age can differ greatly in size and physical maturity… Contact sports have inherent dangers that put young athletes at special risk for severe injuries… to the neck, spinal cord, and growth plates" continues NIAMS. (NIH Publication 04-5278). Sports injuries account for more than 1 in 5 of *all injuries* in the general population of USA. [Pl see table above]

P.E. Bijur & coworkers reported a total of 4,379,000 injuries from sports and recreational activities in 5-17 year olds of which 1,363,000 were serious. The report pointed out that incidence of injury in this age group was higher. "Sports account for 36%, [that is, more than 1 in 3], of injuries from all causes." [Archives of

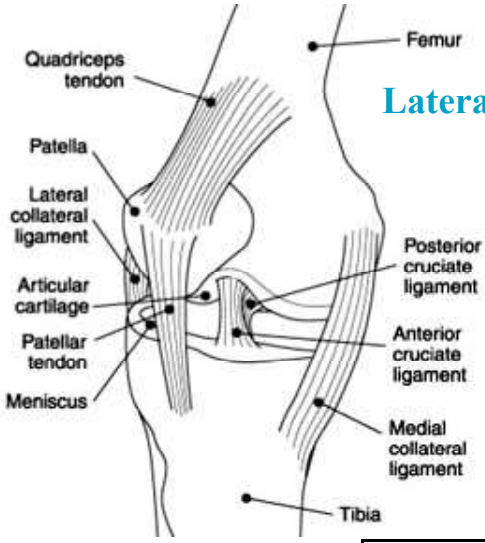
National Center for Health Statistics

Average annual injury visits to hospital emergency departments by persons between 5 and 24 years of age by type of activity performed when injury occurred: United States, 1997-98
http://www.cdc.gov/nchs/about/major/ahcd/injurytable.htm
[retr. 14 September 2006]

	Number of visits in thousands	Percent of visits in thousands	Percent of sports-related injury visits
All injury visits	11,904	100.0	---
All sport-related activities	2,616	22.0	100.0
Group sport	1,170	9.8	44.7
Basketball	447	3.8	17.1
Football	271	2.3	10.3
Baseball/softball	245	2.1	9.4
Soccer	95	0.8	3.6

Pediatrics & Adolescent Medicine, 149 (9), Sep 1995]. Basketball, a game being rigorously promoted globally including Indian schools today, was responsible for most injuries. "Basketball is the most frequent cause of sports-related emergency department visits for youth and adolescents… girls are more likely to be injured than boys, especially with knee and ankle injuries and the knee injuries are more likely to be severe" warns P. Harmer in an article on basketball injuries. [Basketball Injuries, Harmer, P. in *Epidemiology of Pediatric Sports Injuries: Team Sports*.Maffulli N, Caine DJ (eds): Med Sport Sci. Basel, Karger, 2005, vol 49, pp 31-61].

I think it is fitting to point out here that knee joint (which is actually a group of 3 joints, two between femur and tibia, one between kneecap and the femur) injuries are some of the most prevailing in other sports



Lateral View of the Knee

Ref.: National Institute of Arthritis and Musculoskeletal and Skin Diseases http://www.niams.nih.gov/health_info/knee_problems/#4

as well. Serious injury consequences can last a lifetime and discourage even moderate physical activity later on. An authentic source of pertinent information is, *Questions & Answers About ... Knee Problems* [U.S. Department of Health and Human Services, Public Health Service National Institutes of Health National Institute of Arthritis and Musculoskeletal and Skin Diseases NIH Publication No. 06–4912, may 2001, Revised May 2006].

Activity	**% injured in**
Hockey	62.1
Soccer	47.9
Baskettball	43.1
Cricket	35.5
Volleyball	17.7
Body part	**% injured in**
Knee	14.1
Ankle	12.9
Finger	6.8
Lower leg	5.2
Back	5
Skull	1.4

Young People's Participation in Sports and Recreational Activities, and Associated Injuries
Tables 10.1 & 11
[http://www.ausport.gov.au/fulltext/1999/sa/youngpeoples.pdf [Retr. 14 September 2006].

Anatomy & Physiology textbooks in Medical

Schools syllabi list the risk of 8 kinds of knee injuries that can occur in sports.

Warm-up to prevent sport injuries : NIH Publication 06-4912, cited above, urges physical fitness and warm-up to prevent injury in sports, but "the evidence linking physical fitness and prevention of sports injury is slight,…and the same is true of warm-up and stretching programs" write S.W. Marshall and K.M. Guskiewiczj of University of North Carolina at Chapel Hill, USA, in a guest editorial in the prestigious journal, *Injury Prevention* (2003; 9:100-102). The primary determinant of injury potential is the nature of activity with "contact sports carrying the greatest risk", the authors add. J.M. Conn and co-researchers apprehensively articulate that, "As physical activity continues to be promoted as part of a healthy lifestyle, SR (sports & recreational) injuries are becoming an important public health concern for both children and adults." [*Sports and recreation related injury episodes in the US population, 1997–99*, J M Conn, J L Annest and J Gilchrist**,** *Inj Prev* 2003;**9**:117-123].

What appears to be even more worrisome is the caveat in the Surgeon General's 1996 Report, *Physical Activity and Health,* that injuries from sports may act as a disincentive for subsequent participation in further physical activity. "Among high school students, enrollment in physical education remained unchanged during the first half of the 1990s. However, daily attendance in physical education declined from approximately *42* percent to *25* percent [Italics added]," [*Physical Activity and Health: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and

Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996]. It is not unlikely that a good part of this substantial drop may very well be due to the injury potential of sports. Further commenting on the consequences of injury, Marshall and Guskiewicz [referenced above] expressed a wish that "it would have been useful if the authors of the Surgeon General's [1996] report could have made specific recommendations about those physical activities which provide maximal cardioprotective benefits while minimizing the risk of injury". A similar opinion is articulated by Dr. Karen Kramer of the University of South Australia in a thoroughly extensive report entitled *Young People's Participation in Sports and Recreational Activities, and Associated Injury*. Presenting sweeping injury figures from the most played games [please see representative data in the table], and the adverse impact of injury on subsequent physical activity, the author cautions that "If injury, or the fear of it, are reasons for young people dropping out of sport… then low risk activities which can be undertaken with little fuss, and expense may be ideal to promote for young people…" [http://www.ausport.gov.au/fulltext/1999/sa/youngpeoples.pdf [retr. 14 September 2006].

Given the vast potential for injuries from sports, I sometimes wonder whether the discipline of Sports Medicine should not be truthfully and realistically rechristened as Sports-*Injury* Medicine !

Inadequacy, Inferiority, Depression : Repeated failure to develop better skill in games or sports may generate a sense of inadequacy. This is bound to be espe-

cially true for children who are less agile or lacking in limb coordination or overweight to begin with. In sports, children are thrown in to competitive situations with others studying in the same class or grade who may be more physically fit, bigger in body size, and/or more sporty. Challenges and barriers which are surmountable by reasonable amount of effort provide a sense of exhilaration, self-worth and accomplishment. But competing against children of superior physique and talent, who are likely to develop skills faster and thereby widen the gap further, may lead to an ever recurring mind-set of deficiency. Not infrequently such youngsters may also become butts of taunts and impish pranks. Repetitive episodes of frustration and failure do infuse a lack in self-worth and confidence in the human psyche which are likely to trigger a distressing trait of inferiority and depression in the long run. It is not inconceivable that this kind of depression may be a contributory factor to the recent finding that "… by 2020, depression is expected to be second only to heart disease as a source of the global burden of disease" [Murray JL, Lopez AD, editors. *Summary: the global burden of disease.* Boston (MA): Harvard School of Public Health; 1996.].

Moreover, a direct link between depression and weight gain has been reported by McElroy and co-workers: "… Children and adolescents with major depressive disorder appear to manifest an increased risk for subsequently becoming overweight." [McElroy SL, Kotwal R, Malhotra S, Nelson EB, Keck PE, Nemeroff CB. *Are mood disorders and obesity related? A review for the mental health professional.* J Clin Psychiatry 2004;65:634-51.]

For children who do not do too well in studies for

any reason, a feeling of insufficiency may be greatly exacerbated by lesser skill in sports and is likely to lead to further aversion against physical activities resulting in negative health consequences. This may be another reason along with injury that has resulted in a steep decline of daily attendance in physical education from 42 to 25 percent in the American High Schools [*Physical Activity and Health: A Report of the Surgeon General*, 1996].

Not realizing that sports are only peripheral to a fit body and can actually be entirely dispensed with in a health context, this lack of self-worth and depression in their psyche may adversely affect other life activities, such as academics and social relations, as well.

Regularity Potential

Dependence – people, place, equipment

Games & sports generally require special courts and arena to play. Few games and sports in vogue today can be played without equipment. Some entail elaborate paraphernalia which is out of reach for the vast majority of people in resource poor and less developed countries. Minimum number of players is a prerequisite for games & sports. Not infrequently individuals end up spending more time in commuting, marshaling of resources such as playground and equipment, and time-scheduling people for the sport or game than in the actual physical activity itself.

The most organized places for taking part in sports are schools providing pre-college education. Curriculum in schools generally has a game period of 40-45 minutes. Worldwide, schools function for about 180-200 days in a year. What with tests, exams, functions, and

myriad other activities, game periods may only be held for about 170 days during the year. Even the intermittent regularity during school sessions gets broken by long holidays two or three times a year. Thus even in schools where sports form an integral part of the curriculum, physical activity is quite irregular.

For college students and people in jobs or business, constraints of inadequate facilities, frequent travel, time pressures, dependence on others, commuting, etc., taking part in sports can only be a sporadic occurrence.

This means that sports can provide no regularity in physical activity for majority of the populace worldwide.

Probability of continuity beyond school?

Few colleges in developing countries have sport facilities for all students. But even in affluent countries, a game period is not a part of college syllabus. Class schedules are staggered through the entire day and students leave after their classes. Only a small percentage of students participate in organized sports even where facilities exist. Few facilities or opportunities for sports are available to people in most jobs. With worsening traffic snarls, commuting even to work is a hassle let alone another commute for playing games.

How much time?

Beyond school age, what with commuting to the sports ground, waiting for people, an hour or two of play, time spent for skill development; games & sports require considerably more time for any worthwhile workout to burn sufficient calories.

Sports in context of health: Conclusion

I think one can perceive disturbing parallels between sports and highly processed foods.

Highly processed foods do provide nutrition, but sub-standard. Sports do provide physical activity, but sub-standard also. There is little doubt that highly-processed foods give rise to obesity and disease. From the references and discussion above, it is patently evident that sports too inflict injuries, sometimes of a life-long debilitating nature, besides providing insufficient workout, a meagre benefit/cost ratio. Both are extensively covered by mass-media generating huge sums for their promoters and generate enormous profits for their corporate owners. And as the extended discussion above demonstrates, both may very well be significant contributing factors to obesity.

TV sports

> Truly, can you imagine anything more boring than fashion? Professional sports, perhaps. Grown men swatting little balls, while the rest of the world pays *mostly to applaud* [italics added for emphasis].
>
> But you must admit, these are nontrivial issues. We live in a world of frightful givens. It is *given* [italics added] that you will behave like this, *given* [italics added] that you will care about that. No one thinks about the givens. Isn't it amazing? In the information society, nobody thinks. We expected to banish paper, but we actually banished thought.
>
> - Dr. Ian Malcolm in *Jurassic Park* by Michael Chrichton

Sports and their inordinate coverage, by newspapers, magazines, radio, and most especially by TV, is a huge industry with overgenerous earnings and profits for their franchises and top players. Good health, dexterity, agility and quick reflexes of sports-superstars during televised games subtly implant a belief among the watchers that all these highly desirable skills and traits are a consequence of the players' sports activities.

The vast popularity of sports today owes its beginning to the United States Government's initiative in promoting sports for a healthier America. "In the 1950s, we launched the first national effort to encourage young Americans to be physically active, with a *strong emphasis on participation in team sports* [Italics added]", wrote the US Department of Health and Human Services Secretary Donna E. Shalala in the 1996 *Physical Activity and Health* report. Sports participation was to provide a *fun way* [italics added] to carry out physical activity and augment health. Unfortunately, many unforeseen happenings in other spheres made this "strong promotion" of sports an inadvertently counterproductive decision furthering weight gain and obesity in Americans.

Sports on TV capture the masses

In the 1950s, few people had an inkling of the glitzy and overblown role TV was to play in the life of humanity. "In the early days of television, a show couldn't get on the air if there was no sponsor signed on. The advertiser (alone or in partnership with the network) paid the cost of production in exchange for commercials and product plugs throughout the program," says

Billy Ingram [http://www.tvparty.com/vaultcomsp.html]. Budding television industry in the 1950s America was searching desperately for ways to expand programming without exorbitant expense and still lure wide-ranging viewers. TV channels surmised that Government's promotion of sports could provide a great boost to speedy programming. Coverage of sports would be comparatively inexpensive, timely, plentiful and free of hassles. All the multitudes of aggravation associated with actors, costume designers, makeup artists, location & location finders, studio facilities, set designs, and myriad other constraints will no longer pose any hassles. TV coverage of sports was such a simple affair. Except for commentators, camera technicians, and telecommunication personnel, no indispensable human element was required. What was needed were lots and lots of sporting events with competitive rivalries to provoke excitement, brand loyalty (for a team or college or city or state), and shrewd manipulation of time schedules to capture the largest number of viewers. People do have inherent traits of liking & attachment in their psyche; and for most, team loyalty followed automatically for the school, city, state or country of their milieu.

Sensing big money, a concerted effort was launched in USA to bring armchair sports to every home. The first game to be broadcast in color on TV was the Rose Bowl, the college football championship game of the Big-10 mid-west American Universities played on New Year's day in the Disneyland town of California, nick-

named 'The Granddaddy of Them All' in 1962. TV coverage of baseball was started in 1966 and the perpetually super audience catcher Superbowl, the American professional football league championship, was launched on January 1, 1967. American National Collegiate Athletic Association (NCAA) basketball tournament has been broadcast on TV since 1969, and so on to tennis, golf, volleyball, soccer, and myriad other sports, both college and professional. As the local TV stations mushroomed, more and more sports events were broadcast including even the local High School games. The point here is that USA initiated a surge of TV sports broadcast at all hours of day and night for convenience of the viewers from all walks of life.

Over the years, TV industry has uncovered other advantages in screening sports. Much TV programming has been coming under critical scrutiny of sociologists and governments in context of gender issues, race issues, moral & religious & political issues, crime & violence, suitability for children, etc.; and restrictions can always be imposed on programs depending on their theme, content and presentation. But TV sports in general are untouchable and enjoy the widest possible audience including children. For these reasons, astute businesses tend to heartily endorse & sponsor sports on TV. It is a fact of life in today's world that TV programs and serials are primarily made and aired so that *you* are accessible to commercials.

What impact did this have on other countries?

Ever since the Second World War, or perhaps even before that, United States of America had become *the* role

model for rest of the world. As TVs flooded more and more homes worldwide, countries followed the lead of USA; started sports leagues on the US pattern, and aired their own league games in addition to whatever popular games were offered by technologically advanced countries. A strikingly noteworthy example is the formulation of Indian Premier League (IPL) in India early in 21st century. IPL is a cricket league with international players on each team. Mass media is practically the patron saint of the league and newspapers, magazines, radio, and TV are chock-full of the IPL games and players. What is positively alarming with IPL is the nexus of glamor with sports. Many IPL teams are owned by Bollywood (the Hollywood of India located in Mumbai or Bombay) film superstars, and in almost every major game they are likely to be physically present. The prestige of cricket, an entertaining game though of small worth for health, has skyrocketed, and people of all ages including youngsters stay glued to the TV wherever and whenever they can, even neglecting their job or studies. Commuters are busy hearing and watching games from myriad devices available today.

But what is wrong with TV sports?

Fritters away precious time: Today there does not seem to be sufficient time for all the things one needs or wants to do; whether for work, studies or a plethora of entertainments. TV sports with their wide variety from football, soccer, basketball, tennis, golf, volleyball, hockey, ice-hockey to myriad others and their round-the-clock screening tempt people to increase their armchair interest in multiple games costing a substantial amount of time.

Curtailed time for physical activity: As things stand, for majority of people physical activity is not a top priority. But watching TV sports becomes an addiction. The cartoon by the eminent cartoonist Cathy Wilcox brings it out rather classily. This addiction to TV sports is no less an obsession with adults, either.

By Cathy Wilcox
Used by permission

Sports superstars induce playing sports over exercise: Hero worship is quite a general trait, especially among children and youth. Even when they are motivated to engage in physical activities, they are likely to imitate the game or sport played by their hero. A case in point is cricket in India which a majority of youngsters is seen playing on streets, grounds, and fields, burning few calories and expending substantial amounts of time.

Sitting-duck for commercials: Processed-foods, soft drinks, and alcohol, recognized conduits of weight gain, are more heavily promoted during the sports coverage on TV, for the businesses realize that that is one of the most impressionable moment in time to implant their message.

Eric Scholsser refers to confidential documents portraying the policy of McDonald's to foster alliance of sports to its own products. "Ads would link the company's french fries 'to the excitement and fanaticism people feel about the NBA'" he writes in an in-depth analysis of processed-food industry [Fast-Food Na-

tion: The True Cost Of America's Diet, *Rolling Stone* magazine (USA), Issue 794, September 3rd 1998]

American Academy of Pediatrics report entitled *Children, Adolescents, and Advertising* points out that "During prime time, only 1 alcohol ad appear every 4 hours; yet, in sports programming, the frequency increases to 2.4 ads per hour." That is almost a 10-fold boost ! The higher rate of alcohol promotion is cause of distress because "Research has found that adolescent drinkers are more likely to have been exposed to alcohol advertising.[Quotes referenced in *Pediatrics* Vol. 118 No. 6 December 1, 2006, pp. 2563 -2569]

Snacking: Copious amounts of unneeded calories from snacks and drinks are consumed while watching TV sports. Frequent get-togethers with party like atmosphere also induce binge-eating and drinking. It is a commonly observed fact that one tends to eat more if the mind is only partly focused on food. Perhaps the sense of 'fullness' requires mindful awareness, not wholly available while TV viewing, to register satiety.

American Academy of Pediatrics in its policy statement [*Pediatrics* Vol. 128 No. 1 July 1, 2011, pp. 201 -208] supports several of the points made above and adds sleep deprival as an added cause of obesity:

1. Increased sluggishness, less physical activity
2. Increased amount of processed foods in diet influenced by TV ads
3. Increased snacking while watching TV
4. Disturbed and reduced sleep

3. Watching TV for long hours

The habit of watching TV begins very early in life. Andersen and coworkers reported that in the U.S. "the average high-school graduate will have spent approximately 15,000 to 18,000 hours in front of a television set but only about 12,000 hours in school." [Andersen R E, et al. (1998) Relationship of physical activity and television watching with body weight and level of fatness among children. *Journal of American Medical Association* 1998; 279:938-942,959-960.quoted in *Broadcasting bad health:* by IAFCO, cited above]. In 2010, Kaiser Foundation reported that 2/3 of the 8-18 year olds acknowledged in a survey that in their homes TV is turned on during meal times, and nearly half respondents said that in their homes TV is left on most of the time. The youngsters spend about 7 ½ hours in front of screens (TV, video games, computers) every day. [U.S. Department of Health and Human Services. The Surgeon General's Vision for a Healthy and Fit Nation. Rockville, MD: U.S. Department of Health and Human Services, Office of the Surgeon General, January 2010.]

A truly revealing study by Viner & Cole of University College, London, correlated the deleterious effect of weekend TV viewing by five year olds to obesity at the age of 30. The sample population of 5 year olds was 13,135 of which final data was collected from 11,261 thirty year old adults 25 years later. "*Each additional hour* [italics added] of TV watched on weekends at 5 years increased risk of adult obesity (Body Mass Index, BMI, greater than or equal to 30 kg/m^2) by 7%", the authors reported. The unambiguous results from such a large sample led the authors to put forward a general conclusion: "Weekend TV viewing in early childhood

continues [italics added] to influence BMI in adulthood." [*Television viewing in early childhood predicts adult body mass index* by Viner RM, Cole TJ; *The Journal of Pediatrics*. 2005;147(4):429–435]

American Academy of Pediatrics recommends that children should view TV for less than 2 hours a day. Dr. Davison and associates at the University at Albany (SUNY) tracked 169 girls at the age of 7, 9, and 11 years as to the pattern of TV watching and body mass index. The study found that girls watching more than 2 hours of TV "at ages 7, 9, and 11 years were *13.2 times* [italics added] more likely to be overweight at age 11" [*Cross-sectional and longitudinal associations between TV viewing and girls' body mass index, overweight status, and percentage of body fat*, Kirsten K. Davison, Simon J. Marshall, Leann L. Birch; *The Journal of Pediatrics*, Volume 149, Issue 1 , Pages 32-37, July 2006]

A link between TV viewing and curtailed sleep was reported by Drs. Mathias Basner and David Dinges of University of Pennsylvania School of Medicine. Researchers collected American Time Use Survey data from 21,475 people aged 15 or older between 2003-2006. Data revealed that almost 50% of pre-bed time was spent in watching TV. Given the proven correlation of less sleep to increased incidence of obesity and morbidity (general unhealthiness), it is likely that TV viewing is a major factor of reduced hours of sleep, insinuate the authors: "So, in fact, TV may make people stay up late, while alarm clocks make them get up early, potentially reducing sleep time below what is physiologically needed." [Science News, ScienceDaily June 8, 2009; http://www.sciencedaily.com/].

A study involving almost 600 children, 6 – 16 years

old, in Bangalore, India, found that "Decreased duration of sleep and increased television viewing were significantly associated with overweight" [Rebecca Kuriyan, Swarnarekha Bhat, Tinku Thomas, Mario Vaz and Anura V Kurpad, *Television viewing and sleep are associated with overweight among urban and semi-urban South Indian children, Nutrition Journal* 2007, **6**:25].

A similar study involving 4,452 Brazilian adolescents aged 10-12 years by Wells and associates of the Institute of Child Health, London, likewise concluded that "Both short sleep duration and increased television viewing were associated with greater body fatness, obesity and higher blood pressure, independently of physical activity level." [*Sleep patterns and television viewing in relation to obesity and blood pressure: evidence from an adolescent Brazilian birth cohort*, Wells JC, Hallal PC, Reichert FF, Menezes AM, Araújo CL, Victora CG, *Int J Obes (Lond).* 2008 Jul;32(7):1042-9. Epub 2008 Mar 18].

Dr. Robinson of Stanford University designed a school-based study eliminating all other factors except "television viewing behaviors and body fatness. The results of this randomized, controlled trial provide evidence that television viewing is a [direct] cause of increased body fatness", reported the author. [*Television viewing and childhood obesity* by T.N. Robinson, *Pediatric Clinics of North America* 2001 August, 48(4):1017-25]

TV in children's bedroom: A study involving 12,556 children found that "TV in the child's bedroom [by the age of 7] was an independent risk factor for being overweight and increased body fatness [by age 11] in this nationally representative sample of U.K. children" reported Anja Heilmann and associates in *The*

International Journal of Obesity. Commenting on the results of the study, Russel Viner of the Royal College of Paediatrics and Child Health said, "We know that high levels of screen time expose children ...[to] damaging combination of a more sedentary lifestyle, increased exposure to junk food advertising, disruption to sleep and poorer ability to regulate eating habits when watching TV." [Newsweek June 2, 2017; http://www.newsweek.com/childhood-obesity-tv-bedroom-study-links-619563]

Dr. W. Dietz, Director of Nutrition and Physical Activity for the Centers for Disease Control (CDC) of the US Government analyzed a variety of studies which associated weight gain in youngsters with longer TV viewing and vice versa, and concluded that 'Television advertising of food directed at young children may help to explain why reduced television viewing reduces rates of weight gain. [Dietz, W. (2001), editorial in *British Medical Journal*, 322: 313-314].

4. Propaganda, Celebrities and Obesity

"Poor diet and physical inactivity are the most important factors contributing to an epidemic of overweight and obesity in this country" contends the United States Department of Agriculture (USDA) in its 2010 sweeping report on obesity. According to USDA, "the heavy toll of diet-related chronic diseases" includes cardiovascular disease, hypertension, diabetes, cancer and osteoporosis. International Association of Consumer Food Organizations [IACFO comprises of The Food Commission, U.K.; Center for Science in the Public Interest, U.S.A; Center for Science in the Public Interest, Canada; and Japan Offspring Fund] argues that although these diseases are referred to as non-communicable, they in fact are communicable in this sense that they are spread "through the cultural environment – from parents to children, from food corporations to consumers, from industrialised country to less-industrialised country".

Promotion and popularization of 'not so good' [synonymous with the epithets 'highly-processed', or 'ultra-processed' or 'less good' also used in this book] foods are primarily done through advertisement in mass media. In 2013, investment in advertisements topped US$500 billion to nurture a society of consumerism worldwide. Giant corporations specializing in energy-dense, low nutrient foods with a substantial proportion of their income from the 'less good' foods and beverages had already been forking out a huge amount on advertisements by the year 2000; e.g. Nestle ($1.9 billion), Coca-Cola ($1.5 billion), McDonald's ($1.2 bil-

lion), Mars ($1.1 billion), and Pepsi ($0.7 billion). A substantial increase in the advertisement budget by these businesses has continued as is evident by Coca-Cola's global ad expenditure of US$4.03 billion in 2013. In the United States, which accounts for almost 40% of global expenditure on advertisement, Yale University's Rudd Center for Food Policy and Obesity reported that fast food industry spent US$4.2 billion on ads in 2010. Compare this to the meager figure of US$6.5 million [that is about 1 1/2 cents versus 10 dollars] spent by Center for Nutrition Policy and Promotion, a division of the American Government's Department of Agriculture that "works to improve the health and well-being of Americans by developing and promoting dietary guidance that links scientific research to the nutrition needs of consumers."

Q. Why do these kinds of foods get such an exorbitant promotion?

A.: "By and large advertising is directed at selling foods with high levels of fat, sugar and salt." And corporations promoting fast foods and beverages earn a substantial proportion of their income from 'less good' foods; for example, Nestle: 46%; Coca-Cola: 75%; McDonald's: 99%; Hershey Foods: 99%; Pepsi: 79%. Profit margins on such products are exorbitantly high, for example, "In the case of potato crisps and soft drinks, the cost of the basic ingredients is tiny often less than 5% of the marketed cost of the product." [www.eateco.org/PDF/Advertising.pdf [retr May 27, 2011]. As a specific example, consider *french fries.* In the United States, french fries is the single most ordered item in restaurants. Fast-food businesses purchased frozen fries in 1997 for about 30

cents a pound and after reheating in oil sold them for about 6 US dollars. The farmers got some 8 cents for a pound of potatoes. [*Fast-Food Nation: The True cost of America's Diet*, by Eric Schlosser, *Rolling Stone* magazine (USA), Issue 794, September 3rd 1998]

Q. Why and how do advertisements persuade people to buy fast foods despite copious information available about the detrimental effects of these products?

A.: Marshall McLuhan said in his 1964 book, *Understading Media*, "Ads seem to work on the very advanced principle that a small pellet or pattern in a noisy, redundant barrage of repetition will gradually assert itself. Ads push the principle of noise all the way to the plateau of persuasion. They are quite in accord with the procedures of brain-washing."

Well, although the term 'advertising' is typically used for promotion and marketing of goods in general, most fast food advertising has all the hallmark of propaganda and not straightforward advertising.

Q. What do you mean? Is propaganda different from advertisement?

A.: Oh yes, eminently so! William Randolph Hearst, one of the leading 20th century publishers gave pointers to distinguish publicity & advertisement from propaganda. " 'Legitimate publicity' is the spreading of truthful information, or facts, about any cause or condition which is of interest or importance to people generally, and not for the pecuniary or other advantage of the person spreading it." Factual reporting of events or scrupulous information about product ingredients and their proven ef-

fects such as informatory advertisement for medicines approved by the U.S. Government's Food and Drug Administration will fall in to this category. Or advertisements for household gadgets or computers giving specifications of product features and comparative merits will also be good examples of providing requisite information to the public.

"Propaganda is the giving out (or hiring of) opinions, arguments, or pleas to induce people generally to believe what some individual, group of individuals or organizations want them to believe, for the pecuniary or other advantage of the individual, group or organization giving out (or hiring) the propaganda", said Hearst about misleading reporting. "Propaganda is a coordinated set of messages designed to influence public opinion on specific issues or agendas. It is not impartial and presents facts selectively and often in a way to produce an emotional rather than a rational response" asserts The Concerned Citizen's Guide to our American Democracy [http://www.concernedcitizensguide.com; retr June 21, 2010]. An analysis of techniques used in food advertising patently unveils the obvious fact that what the food giants have perfected over decades is the modus operandi of propaganda.

Q. What is the methodology of propaganda; and how did it evolve?

A.: Well, let's take up the evolution of propaganda for mass consumerism first. One of the earliest treatises on how the human mind can be manipulated by implanting selective notions was Gustave Le Bon's *The Crowd: A Study of the Popular Mind* (1896). The in-

sights of this book were in part used for creation of the Creel Commission by the Woodrow Wilson government in USA. Its task was to 'engineer' public opinion in favor of American entry as an ally of Britain in the First World-War which it accomplished with resounding success.

Edward Bernays, a nephew of the psychoanalysis pioneer Sigmund Freud and a key advisor to the Creel Commission, is credited with starting the venture of 'public relations' after World-War I. Its stated purpose was to manipulate mass communication, and influence general public in favor of business. Bernays wrote in "*Propaganda*," (New York: 1928, pp. 47–48) "If we understand the mechanism and motives of the group mind, it is now possible to control and regiment the masses according to our will without their knowing it." Bernays believed that by promoting 'consumerism' (consumer items are relatively frivolous as opposed to 'necessities') through an 'engineering of consent', the ignoble human instincts – illogical impulses, desires, wrath, anger, etc. which were much in limelight owing to the advent of Sigmund Freud's psychoanalysis – could be effectively oriented in a harmless direction. [*Goebbels and today's mass mind control: Part One. How PR opinion-shapers turn the people against their own interests* By Carla Binion; www.onlinejournal.com].

For businesses, the concept of 'consumerism' was naturally very pleasing as it would surely lead to huge earnings. The US government endorsed the idea, for it was an effective means to increasing the Gross National Product (GNP). Successful production and escalating consumption of mass consumer goods that began in the

1920s is a matter of public record.

Adolf Hitler was vastly impressed by the success of Bernays' tactic in promoting 'consumerism'. On becoming Chancellor of Germany in 1933, he created a Ministry of Public Enlightenment and Propaganda to give practical shape to his adage, "Make the lie big, make it simple, keep saying it, and eventually they will believe it". To head the Ministry, he appointed a dedicated Nazi psychologist, Dr. Joseph Goebbels, who was also an ardent admirer of Bernays. It was Dr. Goebbels who perfected a comprehensive program for the dogged persuasion of masses that resulted in virtual brain-washing of a huge majority of Germans in favor of the Nazi ideology. All channels of communication then in vogue, –"art, music, theater, films, books, radio, educational materials, and the press" – were used by this master of psychology, writes Carla Binion.

The overwhelming success of Nazi propaganda deeply worried several prominent businessmen and academics in the United States and, to counter this onslaught, they helped establish in 1937 an Institute of Propaganda Analysis (IPA). Though IPA was wound down shortly after the American entry in to World War II, its analysis pinpointed several key strategies useful for skillful propaganda campaigns.

Q. What are these strategies? Are they used for promotion by the fast food industry?

A.: Of course. What follows is rather a lengthy discussion on IPA identified propaganda strategies and their utilization for promotion of fast foods and beverages.

1. STRATEGY – Card Stacking: literally "to stack the cards" for or against an idea by selective use of facts or logic.

Example: As for instance the fast food industry's campaign to shift the blame for obesity squarely on the shoulders of children themselves: "We are not going to solve this debate by counting calories – it's about getting kids active... Childhood obesity is a major problem and we're doing something practical about it", pontificates Cadbury's statement on its *Get Active campaign* [(2003) http://getactive.cadbury.co.uk]. And "McDonald's and Coca-Cola have both supported the *Step With It* programme to encourage children to measure their walking with a pedometer." [*Broadcasting bad health: Why food marketing to children needs to be controlled,* A report by the International Association of Consumer Food Organizations (IAFCO), 2003]. Many similar ads and representations are advanced by the fast food giants to divert attention away from the role of their products in the obesity epidemic.

Or outright twisting of information to suit their own ends. As for example, the stance of The International Life Science Institute (www.ilsi.org), – founded in 1978 by food giants Heinz, Coca-Cola, Pepsi, General Foods, Kraft and Procter & Gamble – which in a publication claimed that "intake of sugars is inversely associated with the prevalence of obesity" [quoted in IAFCO report, loc.cit.]. If this were true, it must mean that all those worried about obesity, ought to promote higher sugar consumption to curtail weight gain in the general population !!!

(2) STRATEGY – Bandwagon: to give the impression that the idea is supported by everyone.

Multiple ads in mass media displaying consumption of the same fast-food or soft-drink by : family units; adults; teenagers; adolescents; children; all in a veritable mix of race, gender, nationality, culture, etc. to make people believe that all segments of society consume and thoroughly approve of their products.

Many additional channels of communication are available today to the advertising industry than in Dr. Gobbels time,– such as, television advertising, marketing on the Internet, product placement in television programs, DVDs, computer and videogames, peer-to-peer or viral marketing, supermarket sales promotions, cross promotions between films and television programs, sponsorship of school and sporting activities, marketing on mobile phones and branding on toys and clothing, etc. – and they are all utilized by the fast-food industry.

(3) STRATEGY – Testimonial: associating a person of some respected authority (doctor) or visibility (celebrity) with the idea [or product].

Up until the late 1930s and early 1940, few celebrities from the entertainment industry had come to the fore for promoting consumerism. The era of facile mass media came in to its own with the proliferation of television in the 1950s in USA and insidiously ushered the age of celebrities' prominent role in promotion of consumer goods. Today, the most influential of celebrities are either from the show-biz world: actors, actresses, models, musicians, film or TV program producers, directors, anchors; or from the world of sports, the sports-superstars.

Q. Why use celebrities? Don't they increase the cost of ads?

A.: Obviously, it is rather problematic and difficult for the fast-food industry to garner support from unbiased nutritionists and doctors for fast-foods and soft-drinks on the merit of their product ingredients. Hence, the fast-food industry has cottoned on to the psychologically subtle and extremely rewarding tactic of *'emotional* brand bonding.' Katie Bilotti defines "Emotional brand attachment .. as the bond that connects a consumer with a specific brand by involving feelings of affection, passion, and connection." [http://scholarship.claremont.edu/cgi/viewcontent.cgi?article=1257&context=cmc_theses; CMC Senior Theses 2011] Emotional brand bonding utilizes the wide recognizability of a celebrity conjointly with another IPA identified STRATEGY – 'TRANSFER: CARRYING THE PRESTIGE .. OF SOMETHING OVER TO SOMETHING ELSE'; specifically the admiration, adoration, idolization and hero-worship accorded to a celebrity for their excellent performance, good looks, glitter, wealth, or trendy lifestyle, transferred through emotional bonding to a product endorsed by them even though the product or service is wholly outside the area of their competence.

Approximately 25 percent of all advertisements in the United States feature an endorsement by a celebrity and, in some countries, for instance Japan, this number can reach as high as 70 percent [Stephens, A., & Rice, A., "Spicing up the message", Finance Week, 1998, Vol. 76, 46-47; Kilburn, D. (1998). Star power. *Adweek*, 39 (2), 20-21)]. Marketing research has discovered that multiple celebrities in an ad "can have a positive impact" both towards the adver-

tisement as well as buying intention due to a higher believability in the merit of the product. [F. Saleem, *European Journal of Economics, Finance and Administrative Sciences*, issue 8, 128-139 (2007)]. And multiple celebrities will obviously engender a wider consumer base due to an increase in the number of combined admirers & followers. The positive impact is likely to be found also by multiple celebrities appearing in separate ads for the same product.

A 2009 survey found that approximately one quarter of consumers reported having purchased a product because of promotion by a celebrity spokesperson. [MEC Global (2009), "MEC releases its latest Sensor report on Celebrity Endorsements," available at: http://www.mecglobal.com/mec-news/mec-releases-its-latest-sensor-reporton-celebrity-endorsements]. A study commissioned by the WAT-AAH! Foundation, in conjunction with Fit Kids, found that celebrity-endorsed food and beverage advertising campaigns are emotionally and effectively driving America's youth to product consumption. [New York, Dec. 4, 2013 /PRNewswire]

"Celebrities are playing an ever greater role in modern culture and consumption patterns, serving as arbiters of taste, style and public opinion the world over… As famous people are instantly recognisable and attract consumer interest, they can bring attention to a brand in a way that no other type of advertising can" emphasizes Euromonitor Internationl in a high-priced 2014 report on *Celebrity Power and Its Influence on Global Consumer Behaviour*.

Majority of prominent actors, models and musicians from global film, fashion and TV entertainment industries freely engage in promotion of highly-processed foods and beverages. A few examples include: in USA,

Michael Jackson, Mariah Carey, Ricky Martin, Beyonce, Madonna, Bob Dylan, Sofia Vergara, Britney Spears; in the United Kingdom: the pop group 'Spice Girls'; in Greece and Balkan countries: Sakis Rouvas, Inna; East and South East Asia: Leslie Cheung, Jay Chou, Aaron Kwok, Rain, Nicholas Tse, Fave Wong, Momo Wu; in Indian sub-continent: Amitabh Bachchan, Shahrukh Khan, Akshay Kumar, Aamir Khan, Aishwarya Rai, Mahima Chaudhary, Preiti Zinta, Junaid Jamshed, Adnan Sami, Reema Khan; in Australia: Kylie Minogue, Jennifer Hawkins, Holly Valance, Mark Philippoussis, and numerous others.

Sports superstars gain on propaganda potential: Although latecomers in the realm of celebrity endorsement, the sports superstars from all popular sports – soccer, American football, basketball, tennis, cricket – and olympics may actually be gaining ground at the expense of glitzy celebrities in the endorsement business. Sports celebrities are a living personification of good health, physical strength, dexterity and suppleness, and the highly-processed food industry is keenly aware that associating their 'not so good' products to super-healthy individuals effectively offsets most if not all the negative assertions about their products carried out by government and other institutional proclamations. Thus researchers from Yale, Stanford & Duke Universities and Harvard School of Public Health in a study reported that 100 American athletes from Bloomberg Businessweek's 2010 Power 100 rankings (rankings are based on endorsement worth and status in sports) endorsed 512 product brands of which 23.8% (122) were for food & beverages. Of the athlete endorsed items,

79% were for energy dense and nutrition-poor foods, and 93.4% beverages contained 100% calories from added sugar. [Brownwell and coworkers, *Pediatrics* 2013;132;805].

Just a few examples should suffice to demonstrate that topmost luminaries in multiple sports have been engaged in promoting 'not so good foods': Basketball – Michael Jordan, Kobe Bryant, LeBron James, Shaquille O'Neal; American football – Peyton Manning, Eli Manning; Tennis – Serena Williams, Venus Williams; Soccer – David Becham (U.K.); Olympic medal winners – Chris Hoy, Kelly Holmes, Apolo Ohno; and Cricket – Mahendra Singh Dhoni, Sachin Tendulkar, Virat Kohli (India), Adam Gilchrist, Michael Clarke, Shane Warne, Pointing (Australia), and countless others!

There is another pernicious threat of a different type posed by celebrities.

Targeting young children?

Fast-food industry is increasingly targeting very young children as the butt of their ads or shall we say propaganda. Market research and surveys show that parents are letting children (2-17 years) make ever mounting decisions about their meals at home. Thus, children in the United States are choosing what they eat for breakfast almost one third of the time and what they will have for lunch almost a quarter of the time. Equally important, if not more, are items for snacking in between meals which all growing children munch several times a day. In the U.S. households children are able to choose snacks nearly half of the time as well. As an incentive for companies to purchase the report referred to in the Time magazine article, NPD Group, Inc. in-

tones, “By understanding who controls the meal… you can more effectively target your audience.” [http://business.time.com/2013/04/11/american-families-increasingly-let-kids-make-buying-decisions/; https://www.npd.com/lps/pdf/FBS_Generation_Mom_Sample_Information.pdf]

Well, fast-food companies have been making young children (under 8 years) their special targets of ads for some time now. If they can be emotionally bonded to their product at an early age, they will be customers for the longest time. Since their brains are not fully formed they are not able to distinguish fact from fiction. They are therefore extremely impressionable as well.

According to a 2007 report by Federal Trade Commission Bureau of Economics, “children ages 2-11 see more than 25,000 advertisements a year on TV alone.” Center for Science in Public Interest (CSPI) says that “Harry Potter, SpongeBob Squarepants, Winnie the Pooh, Elmo, games, contests, prizes and sports stars are enlisted to entice children to request low-nutrition foods.” [http://cspinet/pesteringparents/pdf] Popular cartoon characters and celebrities including sportstars prominently and temptingly adorn cartons of ‘ultra-processed foods’ in supermarkets as well. Emotional bonding with these characters makes children pester their parents to buy these items despite their own reservations. In the words of Campaign for a Commercial-Free Childhood (ccfc), “companies increasingly rely on children to do their marketing for them.” Is it any wonder then that the ad expenditure targeted at children has zoomed to US$17 billion in 2011, ‘a staggering increase from the $100 million spent in 1983.’ If this were not enough, “In a commercialized culture fraught with troubling trends…

40% of 3-month-old babies [in USA] are regular viewers of screen media." "The more babies engage with screens the less time they spend in creative play–the foundation of learning." Thus, slow language development has been associated with baby video viewing in 8-16 months old babies. [http://www.commercialfreechildhood.org/issues/; retr. March 16, 2016].

Celebrities and fast-food restaurant business : In the United States, there is a strong nexus between celebrities and fast-food chains. Though fashion models, musicians, and TV celebrities also own multiple franchises, by far the most numerous fast-food franchisees are superstars, legends, and hall-of-famers from the world of sports – baseball, basketball, American football, tennis, etc. – who collectively own thousands of fast-food restaurants across America. A few examples of present and past prominent sportstars owning fast-food franchises are, Hank Aaron (baseball); Marcus Allen, Donny Edwards, Kevin Faulk, Drew Bees, Michael Strahan, Peyton Manning (American football); Shaquille O'Neal, Magic Johnson, Jamal Mashburn, Caron Butler (basketball) and Phil Michelson ((golf). Due to their high visibility they lure countless customers – children and adults alike – to these 'ultra-processed food' joints boosting obesity through unhealthy eating habits in the general populace.

But how and why are the celebrities able to significantly influence purchasing behavior?

A.: Thomas Carlyle, 19th century Scottish philosopher & historian said, "... in all times and places, the Hero has been worshipped. It will ever be so. We all

love great men; love, venerate and bow down submissive before great men..." and lamented that, "I am well aware that in these days Hero-worship, the thing I call Hero-worship, professes to have gone out, and finally ceased", referring to the fact that hero-worship of great men of character (moral, ethical, compassion), was waning even in the late nineteenth century. Well, in the 20th century, another category of heroes entered the human scene; celebrities from the world of entertainment. These are not champions of character-building traits but do have mass followings through emotional-bonding which many of them exploit for promoting 'not so good' foods and beverages.

Given below are some reasons as to why celebrities may have gained inordinate power of persuasion on people in general and children in particular:

* Human beings are programmed to learn things from the environment. "Process of learning from other people's behavior, is a central idea of social cognitive theory … This idea asserts that individuals can witness observed behaviors of others and then reproduce the same actions. Social cognitive theory is applied today in many different arenas. Mass media, public health, education, and marketing are just a very few. An example of this is the use of celebrities to endorse and introduce any number of products." [http://en.wikipedia.org/wiki/Social_cognitive_theory.[retr Mar 10, 2012]

* It is a matter of daily observation that whatever the senses take in, grabs the attention of the mind. Thus people can be seen to discuss items they have read in newspapers & magazines, heard on the radio, or watched on TV the preceding evening. Repeated celebrity

promoted fast-food ads on electronic as well as print media implant and renew the lure for 'not so good' foods and beverages.

* Superior skill & performance in their profession makes celebrities icons to be looked-up to and admired. "During their careers, successful individuals are elevated to the celebrity status … and popularity makes these celebrities look attractive to consumers", writes Rajni Surana in her Master's dissertation submitted to The University of Nottingham [*The Effectiveness of Celebrity Endorsement in India,* http://edissertations.nottingham.ac.uk/2069/1/08MAlixrs13.pdf]

* Celebrities are rich, famous and their exhibited lifestyle is envied and coveted. They seemingly personify the achievement of the unfulfilled desires of general human nature.

* Whatever the public sees are mainly good aspects of the celebrities. In contrast, parents and teachers are seen and observed in all their human limitations and flaws. Compared to celebrities they also lack glamor and charisma. Distant drums sound melodious.

* Mass Media provides extensive coverage of celebrities to whet curiosity and stimulate emotional bonding. Rajni Surana in her dissertation refers to the case of an actor from South India "who has temples dedicated to his glory." [Surana, loc.cit.] People in turn buy more magazines, newspapers, and tabloids or watch TV to gather details about them. Celebrities and media thereby form a ploy for the benefit of both. The Phenomenal Impact of Celebrities on people can be gauzed from the following financial blog:

"THE POWER OF LEVERAGE. One teacher impacts 30 kids in a classroom. A doctor (a GP) … can see 1000 patients a YEAR … whereas a cricketer's actions are taken across 100 million people. It goes on the net, on television, then there is print media, mobile, …" [http://www.subramoney.com/2011/01/gautam-ganbhir-and-ipl-auction/; retr Feb 19, 2016] And the same is true the world over: basketball & football stars in America; soccer superstars in Europe and South America; cricket stars in U.K., Africa, Asia, Australia, whose actions are watched by billions across the globe practically all days of the year.

* Improbability of personal contact with celebrities creates a longing for some kind of link and provokes susceptibility for imitation and indiscriminate following of their promotions. "A celebrity's stamp of approval can create an emotional bond between the endorser and the consumer, if the fit is right" [(Bradley, 1996). Quoted in Surana, op.cit.]. Surana gives an example of this phenomenon by quoting an adult's response in these words: "when I was younger I made it a point to buy whatever was endorsed by Shah Rukh Khan [famous Indian actor]. I was fascinated by him."

* Parents can't spare sufficient time for children in today's time-starved schedules due to pressures of work and their personal lifestyle interests; hence celebrities become surrogate icons to admire and emulate by default.

4. STRATEGY – Glittering Generality: associating something with a virtue word; the opposite of name-calling (freedom, democracy); often used to make us accept a concept without thoroughly examining its application.

"*All soft drinks* [italics added] are healthy because they provide the *vital fluids* [italics added] our bodies need with *some* [italics added] also providing contributions to the various vitamins and minerals we need every day", claims British Soft Drinks Association, the trade body that lobbies government and, provides 'scientific evidence', as above, on its website www.britishsoftdrinks.com' [quoted in *Children, Adolescents, Obesity, and the Media*, Pediatrics July 1, 2011; Vol. 128 (1),) pp. 201 -208]. Here the words 'vital fluids' are used to implant the notion that soft drinks are an important source for keeping the body hydrated without at all alluding to their potentially deleterious effects and never mentioning plain water as the prime hydrating source.

Most concepts for propaganda mentioned above were developed in the first half of twentieth century. The second half of 20th century, however, began another momentous endeavor for the advertisement industry, initiated and backed by discoveries in biological sciences.

What is that venture?

Marshall McLuhan in his *Understanding Media: The Extensions of man* said of the advertisements, especially the costly ones:

"Ads are not meant for conscious consumption. They are intended as subliminal pills for the subconscious in order to exercise an hypnotic spell."

"Any expensive ad is as carefully built on the tested foundations of public stereotypes or "sets" of established attitudes, as any skyscraper is built on bedrock."

How far that testing and psychological research for promotion of goods has progressed is narrated by Jonathan Leake in an article captioned, *Science finds brainwaves that make shoppers spend* (The Sunday Times, London, August 8, 1999). "The research is the first to show the unconscious workings of consumers' minds" writes Leake. The research conducted by Gerald Zaltman of Harvard Business School in collaboration with Harvard's professor of Psychology, Stephen Kolllyn, mapped out blood flow and electrical activity locating spots of 'yea' and 'nay' in the brain associated with multiple retail strategies. "We are lighting up the shadows of the mind and showing what happens when consumers make decisions," said Zaltman, adding, "When it comes to shopping, what people say and think are very different from what they actually do." The results of this brain research therefore will help in targeting consumers' purchasing decisions more markedly.

In 2012, a team of researchers led by Dr. Brian Pasley of the University of California at Berkeley "recorded the complex patterns of electrical activity generated by someone's brain, as the subject listened to someone [else] talking. By feeding those brainwave patterns into a computer, they were able to translate them back into actual words — the same words that the volunteer had been hearing", reports David Derbyshire in MailOnline of 2 February 2012 [http://www.dailymail.co.uk/sciencetech/article-2095214/As-scientists-discover-translate-brainwaves-words].

Dr Mark Lythgoe, a brain scanner researcher at University College London reportedly said about this research, 'I'm quite shocked at the advances that have

been made in the past five years. In the future you are going to be able to see major things — such as colours, or words that have an emotional content — using these sorts of techniques", giving credence to Harvard researchers' prophesy quoted in August 1999 issue of *The London Sunday Times* article of "powerful new marketing techniques, including the 'everlasting jingle' which consumers will find even more difficult than usual to get out of their heads."

A related topic of brain research involved "brain scans to read people's memories" by University College London scientists, Eleanor Maguire and Demis Hassabis, in 2009. "Solely from the pattern of activity in their hippocampus, we could predict what memories a person was recalling" Maguire said. "The discovery that spatial memories are encoded in a predictable way in our brains will give scientists confidence that other memories might be readable using brain scanners" wrote Ian Sample reporting the findings in *The Guardian* (12 March 2009).

So what could be some of the implications of this brain research?

Using scientific research for profit has always been compelling. A recent example is of the extremely intricate recombinant DNA research utilized for growing square watermelons, thick skin tomatoes, etc. for compact packing or longer shelf life. Modern brain research is likely to help the fast food industry in several ways:

1. Use words, colors, jingles in the mass media – billboards, print media, TV, internet – to directly impact the unconscious (the sub-conscious) for implanting long-

lasting emotional bonding and memory of their products in all consumers – children and adults alike.

2. To create even more overpowering environment in stores and sales outlets for their products.

It is almost a given that with enormous resources at their disposal, all state-of-the-art scientific research and discoveries will be used by the fast-food corporations in marketing. So that, if their products look only attractive to consumers today, they will become irresistible to the decision-making part of the brain conforming to the adage of McLuhan about ads, literally, “They are quite in accord with the procedures of brain-washing”, and one can regrettably expect a further boost in sales of ultra-processed foods and other detrimental lifestyle changes.

5. Obesity and Chemicals

Hundreds of thousands man-made chemicals are in commercial use. Worldwide sales of chemicals have increased from US$171 billion in 1970 to US$4,000 billion in 2013. It is estimated that 30,000 man made chemicals are constituent parts of common household products. The range of chemicals impinging human environment is truly vast and includes pesticides, dyes, preservatives, colorings, flavorings, food-additives, perfumes & cosmetics, resins, plastics, intermediate chemicals used in manufacturing, solvents, surfactants, building materials, and innumerable others. Over the past several decades, many of them have been suspected or implicated in numerous health disorders such as cancer, liver & kidney damage, respiratory problems, birth defects, allergy, depression, behaviorial maladies and mental disorders. But it has only been in the last few years that some of the chemicals, the ones that are labeled as endocrine disrupting chemicals (EDCs), have generated deep concern in the scientific community about their probable role directly as a cause of weight gain and obesity. “The commonly held causes of obesity – overeating and inactivity – do not explain the current obesity epidemic. Because the obesity epidemic occurred relatively quickly, it has been suggested .. that the earth’s environment has changed significantly during the last few decades because of the exponential production and usage of synthetic organic and inorganic chemicals. Many of these chemicals.. at.. lower concentrations.. have powerful weight-promoting actions”, writes Paula F. Baillie-Hamilton in a review article, *Chemical Toxins: A Hypothesis to Explain the*

Global Obesity Epidemic [J Altern Complement Med, 2002;8 (2):185-92.].

What does the term endocrine mean?

Endocrine glands in human body produce secretions known as hormones which are released directly into the blood stream and transported to body tissues and organs. Hormones, which can function effectively in extremely minute concentrations (from part-per-billion, ppb, to part-per-trillion, ppt), serve as communication mechanisms with body tissues & organs and, also regulate virtually all body functions from development in the womb, to growth, to overall health and reproduction. Just as an overview, hormones secreted by:

Adrenal glands
influence body's metabolism, blood chemicals, and body characteristics, response and defence mechanism against stress.

Hypothalamus
regulate involuntary body functions, sleep, appetite, etc.

Ovaries and testicles
influence gender characteristics, reproduction mechanism.

Pancreas
regulate use of glucose by the body.

Parathyroid glands
regulate calcium level in the blood.

Pineal body
influences biological rythms.

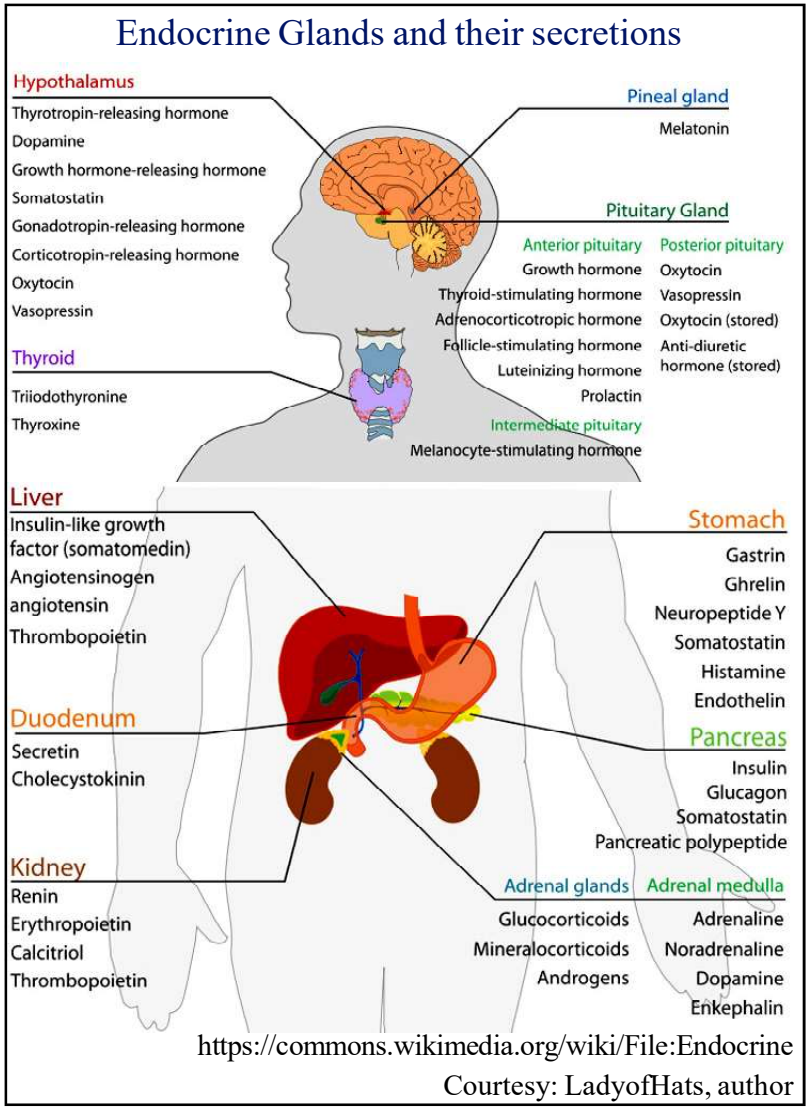
Pituitary gland
influences other endocrine glands.

Thymus gland

influences body's immune system.

Thyroid gland

influences body heat, bone growth, body's metabolism.



https://commons.wikimedia.org/wiki/File:Endocrine

Courtesy: LadyofHats, author

Endocrine disrupting chemicals (EDCs) have recently been defined by the Endocrine Society as: "an exogenous [non-natural] chemical, or mixture of chemicals, that interferes with any aspect of hormone action" including normal production and functioning of hormones. By turn of the 21st century, there appeared to be sufficient grounds through ever burgeoning scientific research to suspect that this disruption in the normal operation of hormones by EDCs may be a link to a vast gamut of maladies such as:

* genetic abnormalities
* growth disorders including metabolic disorders
* behavioral disorders
* short stature
* calcium & bone disorders
* diabetes
* adrenal disease
* disorders of puberty
* thyroid disease
* fertility disorders
* tumors & cancers
* endocrine hypertension
* OBESITY
* menopausal irregularities
* osteoporosis
* impotence, etc.

Today some 1,000 chemicals are suspected of being EDCs and since humans are exposed to a plethora of these, it is not so easy to link a particular chemical to a specific disorder. Besides, a chemical may be responsible for not one but multiple disorders. Additionally, various ingested chemicals may be potentiating each other's

activity, or reacting to form newer compounds through the presence of thousands of enzymes (which are present in cells and tissues to catalyze and facilitate myriad chemical reactions) within the body; thus any number of possibilities exist.

It may neither be ethical nor possible to test the deleterious effect of a chemical on human body directly. Much information in science is therefore gathered from epidemiological data [Epidemiology is the study .. of the distribution .. and determinants (causes, risk factors) of health-related states and events .. in specified populations .., and the application of .. this study to the control of health problems [in the community]. Another way to discover a potentially harmful effect is through animal studies. Similarities of genes in animals and human beings when taken in to consideration, may and do provide fairly reliable markers to a possible link between a compound and its beneficial (as in testing of potential medicines) or harmful effect on human beings.

Which endocrine disrupters in products pose alarming threats of obesity in human beings?

Perfluorooctanoic Acid (PFOA) is a synthetic chemical used in non-stick cookware and used for generating a non-sticking lining in myriad pots, pans, cans, pizza boxes, microwave popcorn, water-resistant clothing, stain-resistant carpets, carpet cleaning solutions and some paints. Because it is used in common household products, PFOA has allegedly been found in the blood of more than 98% of United States population. A host of diseases such as thyroid disorders, low birth weight, kidney disease, etc. have been linked to PFOA in hu-

mans. In one study, exposure to PFOA in the womb resulted in significant weight gain in post pubertal female mice. The results of this animal study were confirmed by a team of Danish researchers in a study involving 665 women. "Women exposed while in the womb to low levels of a common stain repellent are three times as likely to gain more weight and have large waists as young adults [20 years later] than women less exposed during development. This is the first time that this chemical, known as PFOA, has been linked to obesity in humans" writes Glenys Webster in an article, *Women's chemical exposure during pregnancy promotes obesity in daughters* in Environmental Health News [http://www.environmentalhealthnews.org/ehs/newscience/2012/03/2012-0418-prebirth-PFOA-obese-women/]

This also means that very young children, who crawl on the floor for substantial amounts of time and put their fingers or toys in the mouth ingesting flame retardants, stain repellents and other chemicals which stick to dust particles, are at even greater risk of being adversely affected by this obesogen.

Tributyltin (TBT) is used as a fungicide. Applications include treatment of boats & ships to prevent growth of marine organisms. More generally, it is used in wood preservatives and industrial water systems, disposable diapers and toilet paper. Some scientists suspect that tributyltin and other organotin compounds may act as endocrine disruptors in humans and contribute to obesity by increasing the number of fat cells.

Atrazine is one of the most widely used herbicides in the United States. It has been statistically determined that areas inundated with higher amounts of atrazine are also high in the prevalence of human obesity.

Plastics and obesity: Surprisingly however, the biggest, because most pervasive, chemically-induced threat of obesity appears to be from plastics and chemicals associated with plastics. A comparatively recent addition to the planet's environment, plastics have become so ubiquitous today as to defy imagining a life without them. From production volume of a mere 1.5 million tons in 1950, their manufacture and consumption worldwide zoomed to a mind-boggling 300 million tons by 2013. That is a yearly global average [2013 Pop. 7,100 million] of over 42 kilograms (93 pounds) of plastic for each man, woman and child on the planet !! The amount of natural resources required for making plastics is phenomenal. Apparently, 8% of world's annual output of the precious non-renewable petroleum is used in plastic production: 4% as raw material, and 4% as energy in processing.

A probable link of plastic constituents to obesity epidemic was first advanced by Dr. Paula F. Bailie-Hamilton of Scotland's Stirling University in 2002 in her ground-breaking hypothesis of a connection between synthetic chemicals and human health. Not all plastics are implicated in endocrine disruption. But it may be safely said that all individuals are exposed to EDCs dispensed through plastics because of their extensive use in all life situations and activities. Her theory specifically mentioned two major classes of endocrine disrupters,

phthalates and Bisphenol A (BPA), both used on a big scale in formulation of plastics.

Phthalates

These are a class of chemicals commonly used as plasticizers. Plasticizers are chemicals that are required in the softening process to convert hard plastics such as Polyvinyl Chloride (PVC) polymer to more flexible forms which can then be molded to manufacture a wide variety of products, such as:

* pipes and tubing
* construction materials
* packaging
* electrical wiring
* sheets, film, wall, roof and floor coverings
* tablecloths
* carpet backings
* shower curtains
* garden hoses
* pesticides
* pacifiers, teething rings, crib bumpers
* toys
* coatings, leather imitations (automobile upholstery, home furniture), shoes, rainwear
* pastes for sealing and isolation; plastisols (e.g. car undercoating)
* food packaging
* medical tubing, blood storage bags, intravenous tubing
* lacquers and paints
* adhesives and fillers

* printing inks
* dielectric fluids in capacitators

According to United States Environmental Protection Agency's *2012 Phthalates Action Plan*, some 470 million pounds (214 million kilograms) of phthalates are used in USA every year. The higher the proportion of phthalates with PVC, the higher the flexibility of the resultant product. The essential drawback of plasticized plastic is that phthalates are not strongly bonded to the plastic polymer "in these products and can therefore leach out" and contaminate foods, water supply and the air we breathe. That 'new car smell' is off-gassing of plasticizers from the plastic upholstery. A study carried out in Sweden discovered that children (who habitually play and spend time nearer to the floor) can absorb airborne phthalates from plastic carpeting through their skin and respiratory tracts. In a study by the Centers for Disease Control and Prevention (CDC), most Americans tested positive for phthalate metabolites (breakdown products of phthalates) in their urine.

Among other items in common use, Phthalates may also be present in personal care products, such as:

* cosmetics
* nail polish
* hair products
* skin care products e.g. shampoos, perfumes
* detergents & soaps
* time-release medications

[America's Children and the Environment, 3rd Ed. http://www2.epa.gov/sites/production/files/2015-06/documents/ace3_2013.pdf]

"Multiple studies in humans have shown that phthalates levels in the body are associated with abdominal obesity, increased waist circumference and insulin resistance, especially in men" reports Kris Gunnars in an article citing studies published in several scientific journals – *Environmental Research* (January 2012); *Environmental Health* (3 June 2008); and *Environmental Health Perspectives* (June 2007). [http://authoritynutrition.com/5-chemicals-that-are-making-you-fat/; November 2015]

Results of a so called East Harlem Study present "some of the first evidence linking obesity and endocrine disruptors in humans", reports New York Times. The study involved several hundred children in two groups, one of kindergarten age and the other of children ranging from 9 to 11. "Levels of phthalates measured in children in both studies are significantly higher than levels … across the entire United States… Nearly 40 percent children in East Harlem are overweight" according to the article. Dr. Philip J. Landrigan, one of the leading researchers is quoted as saying that the "impact of endocrine disruptors on obesity could be more significant than many people believe." [*Child Obesity Is Linked to Chemicals in Plastics* By JENNIFER 8. LEE; April 17, 2009;http://cityroom.blogs.nytimes.com/2009/04/17/child-obesity-is-linked-to-chemicals-in-plastics/]

After adjusting for other variables such as age, race, food intake, physical activity and smoking, a University of Rochester Medical Center study concluded that "men with the highest levels of phthalates in their urine had more belly fat and insulin resistance." Lead author Richard Stahlhut advanced the hypothesis that phthalates

act by lowering testosterone levels. "Low testosterone appears to cause increased belly fat and pre-diabetes in men." [*Obesity In Men Linked To Common Chemical Found In Plastic And Soap*, ScienceDaily, March 14, 2007; http://www.sciencedaily.com/releases/2007/03/070314110441.htm]

Bisphenol A (BPA) and derivatives

BPA is one of the largest volume chemicals produced worldwide with an estimated annual production exceeding 5.4 million tons (12 billion pounds; 5.45 billion kilograms) by 2015 of which about 100-150 tons (220,000-330,000 pounds) are estimated to be released directly in to the atmosphere. It is mainly used in manufacture of polycarbonate plastics and epoxy resins. BPA incorporated plastics are transparent and sturdy and are used in the manufacture of a variety of common products, such as:

* Water bottles
* Sport Equipment
* CDs and DVDs
* Food and drink containers
* Metallic food and drink containers
* Thermal paper e.g. receipts from cash register
* Toilet paper
* Casts and moldings in PVC and metal industries
* Dental sealants and tooth coatings
* Fertilizers

Scientific studies have verified the presence of BPA in dust, groundwater, and sea water. Recent measurements have also disclosed significant levels of BPA in the atmosphere of many regions globally. In 2005, Centers for Disease Control and Prevention (CDC) of the

U.S. Government found detectable levels of BPA in the urine of 93% of American adults. It has also been found that "the time of greatest sensitivity to BPA is in the womb and 96% of pregnant women in the USA test positive for BPA in their urine." [Environ Health Perspective, June 2011]. Lori Hoepner of Columbia Center for Children's Environemental Health and assistant professor at State University of New York Medical Center and colleagues validated in a 2016 study involving 369 mother-child pairs in New York City that "higher exposure to BPA before birth—estimated by looking at the mothers' third trimester urine—meant the children at age 7 had higher body fat masses and waist sizes." [http://www.environmentalhealthnews.org/ehs/news/2016/may/more-bpa-exposure-as-a-fetus-leaves-kids-fatter-at-age-7-nyc-study]

Since human body is known to metabolize BPA fairly quickly, this presence of BPA indicates that exposure to and absorption of BPA in human beings is a regular and ongoing feature." Researchers also say that "the highest estimated daily intake of bisphenol A in the general population occur in infants and children."

"Multiple studies have associated BPA exposure with weight gain and obesity, in both lab animals and humans" writes Kris Gunnars in November 2015 *Authority Nutrition* [http://authoritynutrition.com/5-chemicals-that-are-making-you-fat/] referencing studies from scientific journals – *Environmental Research* (June 2011); *The Journal of Clinical Endocrinology & Metabolism* (Online November 16, 2011); *Endocrinology Journal* (April 2004) and *Neurotoxicology and Teratology* (July-August 2011).

Environmental Working Group's [http://www.ewg.org/research/bisphenol; March 5, 2007] article on Bisphenol A cit-

ing Masuno & coworkers' research [Journal of Lipid Research (2002), 3:676] states that "low doses of BPA spur the formation and growth of fat cells, the two factors that drive obesity in humans."

Toxicity of BPA is very broad. It can allegedly affect the behavior of over 1% of human genes, that is, more than 200 genes, controlling development and repair of almost all organs and tissues in the body.

BPA is allegedly responsible for disrupting proper functioning of crucial biological pathways in weight homeostasis. Homeostasis mode is the body's preference for an internal steady state. For example, body maintains an internal organ temperature of 98.6 degrees F (37 degree Celsius) despite variations of temperature in the external environment. Malfunction of weight homeostasis causes obesity in two ways: one, it increases the number of fat cells and, two, it makes the fat cells fatter.

Dr. Angel Nadel of Spain's Miguel Hernendez University is an expert on BPA's adverse health effects leading to obesity. "When you eat something with BPA, it's like telling your organs that you are eating more than you are really eating", says Dr. Nadel, who in association with his coworkers discovered that a quarter of one billionth of a gram of BPA could initiate production of twice the amount of insulin actually needed. How minuscule this amount actually is, can be perceived by realizing that this translates in to a mere 1 gram ($1/28^{th}$ of an ounce) of bisphenol A can double the production of insulin secretion in 4,000 million people, more than half of the 2015 world population ! Over production of insulin results in lowering of blood sugar which in turn generates higher appetite.

A particularly revealing study of the deleterious effects of BPA derivatives on transparent zebrafish, where one could actually see the accumlation of fat, was reported by researchers from University of Houston's Center for Nuclear Receptors and Cell Signaling (CNRCS). The research found that Tetrabromobisphenol A (TBBPA) and tetrachlorobisphenol A (TCBPA) treated zebrafish became heavier. "The transparency of zebrafish allowed us to see .. lipids accumulated in the liver, the heart region, the head .. blood vessels.. [and] subcutaneously along the side of the fish" said Maria Bondesson, assistant proferssor of biology and biochemistry at the CNRCS. Both of these compounds produced to the tune of 150,000 tons (TBBPA) and 10,000 tons (TCBPA) per year, are used extensively "to keep electronics from overheating and are found in computers, cell phones, televisions, tablets, video game consoles and other high-tech devices with electrical chips that could catch fire if they get overheated" from which gadgets they are slowly released in to the air we inhale. "Given the growing obesity epidemic and the serious health conditions it often leads to, our research shows that it's important to study if chemicals are obesogens," stated Bondesson. [*UH Researchers Find Link Between Flame Retardants and Obesity*, http://www.uh.edu/news-events/stories/2015/March/030415zebrafish]

Concluding remarks on EDCs:

EDCs often disrupt endocrine systems by activating processes which in normal course would have been properly initiated by natual hormones. Or, they can bind to the active site of a natural hormone so that the site is blocked and hormone initiated process can not take

place.

Excessive calories ingested through consumption of 'Not so good' foods and beverages can be burned by drastic measures such as vigorous long-term physical activity. But endocrine disruptors upset the normal function of the bodily systems, for example by decreasing levels of testosterone thereby leading to weight gain as Dr. Richar Stahlhut suggests, and may not be prone to such simple solutions as enhanced levels of physical activity. Dr. Bruce Blumberg of the University of California at Irvine has even coined a new term for these chemicals and their fat inducing property. He calls them 'obesogens' (obesity causing), similar to the generally used 'carcinogen' for cancer causing substances.

And it turns out that fat cells are not merely a device to store energy, but much more. "Now we know that fat is a complicated hormone gland that is capable of communicating with other tissues, such as the brain and immune system," says Dr. John Molot of University of Toronto Environmental Health Clinic, and that "There are many chemicals in the environment that make you gain weight and make it more difficult to lose weight." [U.S. News & World Report, May 1, 2015]

Environmental Protection Agency of the United States Government cautions that "Environmental contaminants can affect children quite differently than adults, both because children may be more highly exposed to contaminants, and because they are often more vulnerable to the toxic effects of contaminants."

"Children generally eat more food, drink more water, and breathe more air relative to their size than adults do, and consequently may be exposed to relatively higher

amounts of environmental chemicals. Children's normal activities, such as putting their hands in their mouths or playing on the ground, can result in exposures to chemicals that adults do not face. In addition, some environmental contaminants may affect children disproportionately because their bodies are not fully developed and their growing organs can be more easily harmed." [https://www.epa.gov/sites/production/files/2015-06/documents/ace3_2013.pdf]

"We need to be super concerned about our kids," says environmental health researcher Margaret Sears who is associated with Children's Hospiral of Eastern Ontario Research Institute. "There are chemicals that can affect the number of fat cells that your body makes as you're growing as a child. Although fat cells can get larger or smaller, it's much more difficult to destroy fat cells when you are older if you created a lot of fat cells as a child." [U.S. News & World Report, May 1, 2015]

EDCs have been detected in blood, fat, urine and other tissues of human beings worldwide. Practically all pathways can be used by the EDCs to enter the humans, such as food, water, air, and skin absorption. According to the Endocrine Society, evidence is accumulating that EDCs can instigate changes in germ cells (from which human sperm and egg cells are formed) making their effects to pass on to the progeny "not just to one's own children, but also to grandchildren, great-grandchildren, and beyond. In other words, children can inherit the negative consequences induced by the exposures of their ancestors. This is very important, because it underscores the point that the introduction of a chemical into the environment, if it affects the germ cells, will be

inherited long after the chemical is cleaned up or breaks down for generations to come irrespective of the cleanup of the environment." [Introduction to Endocrine Disrupting Chemicals.pdf; http://www.endocrine.org]

Air Pollution and Obesity

In a news capsule, Magaly Olivero also laid the blame of a high risk of obesity from air pollutants like polycyclic aromatic hydrocarbons from motor vehicle exhaust, residential heating, oil refining, charbroiled foods and cigarette smoke. "One study found that kids with high exposure to these chemicals are more likely to be obese," Dr. John Molot of University of Toronto-affiliated Environment Health Clinic says. "Children born to mothers who had higher exposures to these pollutants are more likely to be programmed to become obese." [U.S. News & World Report, 1 May 2015; http://health.usnews.com/health-news/health-wellness/articles/2015/05/01/obesogens-the-environmental-link-to-obesity]

Rampant air pollution in many regions of the world could turn out to be one of the significant causes of the globesity epidemic. A study appearing in the March 2016 issue of the *Journal of the Federation of American Societies for Experimental Biology* (FASEB) agrees with this assessment; it found that pregnant rats and their offspring exposed to the polluted Beijing (China) air for 19 days showed "increased tissue inflammation". Commenting on the results, Junfeng "Jim" Zhang, professor of global and environmental health at Duke University of North Carolina and senior author of the research paper, said that "Since chronic inflammation is recognized

as a factor contributing to obesity ... our findings provide clear evidence that chronic exposure to air pollution increases the risk for developing obesity ... If translated and verified in humans, these findings will support the urgent need to reduce air pollution, given the growing burden of obesity in today's highly polluted world." "The findings also echo previous studies linking air pollution with increased insulin resistance and altered fat tissue," writes Tim Lucas in a news capsule of the Duke's Nicholas School of the Environment and the Duke Global Health Institute.

A study, by researchers from Indian Institute of Tropical Meterology and United States National Center for Atmospheric Research in Boulder (Colorado) published in *Geophysical Research Letters* indicates that India is way ahead of even China in air pollution. The study estimates that outdoor Indian air pollution may have caused 570,000 premature deaths in 2011, shortening lives of Indians by an average of 3.4 years and of highly polluted Delhi residents by 6.3 years. Though no estimates were made specifically for obesity, the economic cost of premature mortalities was estimated at US$640 billion in 2011, a figure "about 10 times higher than the country's total expenditures on heatlh that year." [https://www.washingtonpost.com/news/energy-environment/wp/2016/05/11/air-pollution-in-india-is-so-bad-that-it-kills-half-a-million-people-every-year/]. Given the research from China cited above, it is very likely that obesity was one of the significant routes through which the premature mortality occured.

6. Sickness, Medications and Obesity

Drugs prescribed for many chronic diseases associated with weight problems have been found to worsen the problem of overweight and obesity. "It's a vicious cycle because patients already at risk for weight-related health conditions often receive medications that can exacerbate their problems," says Kelly Lee, associate professor of clinical pharmacy at the University of San Diego Skaggs School of Pharmacy and Pharmaceutical Sciences. In an article *Wide Effect: Drugs That Promote Weight Gain* [http://health.ucsd.edu/news/features/Pages/2015-03-03-weight-gain-and-medications.aspx], Christina Johnson lists six types of maladies for which prescribed medicines can induce significant boost in weight. These include medications against depression; allergies including the common hay fever; hypertension & heart disease; inflammation; type 1 & 2 diabetes; and serious mental disorders such as schizophrenia, mania or severe anxiety. As an example of the conundrum in treatment of chronic ailments, she writes: "the antidepressant mirtazapine (Remeron) is so potent at promoting weight gain that it is sometimes prescribed to underweight senior adults and AIDS patients." This is on top of the finding by a team of researchers from Leiden University Medical Center in Holland that "depressed persons had a 58% increased risk of becoming *obese* [Italics added]" to begin with. As another striking example of medication induced weight gain is the affirmation of Dr. Lee: "I have personally seen patients gain 50 or 60 pounds within a year of starting an antipsychotic."

An earlier article *Huge weight gains reported by patients on prescription drugs* by Roger Dobson refers to a study by researchers from Glasgow University and Glasgow Royal Infirmary of Scotland which even quantifies the extent of weight gain from various medications. The study was based on data collected from more than 25,000 people in Britain. [http://www.independent.co.uk/life-style/health-and-families/health-news/huge-weight-gains-reported-by-patients-on-prescription-drugs-454472.html; posted 24 June 2007]. The report gives the following conspicuous figures for weight gain by use of prescription drugs for various conditions in 52 weeks:

Medication for	Weight gain in 52 weeks
Psychiatric disorders	up to 22 lbs. (10 kgs.)
Type 2 diabetes	up to 13.2 lbs. (6 kgs.)
Depression	up to 8 lbs. (3.6 kgs.)
High blood pressure	up to 3 lbs. (1.4 kgs.)
Heart condition	up to 5 lbs. (2.3 kgs.)
Epilepsy	12 lbs. (5.4 kgs.) or more
Bipolar disorder	about 8 lbs. (3.6 kgs.)

As an indicator of the widespread nature of prescription medication, consider the statistic: in USA an estimated 50 million (16% of US population) people suffer from hay fever and allergies alone. And in the United Kingdom, 4 million Britons were reportedly suffering from heart disease, epilepsy and type 2 diabetes in 2004-2005, for the relief of which conditions they were all taking some kind of medication. It is therefore obvious that side effects of prescribed drugs might be responsible for a significant proportion of the worldwide globesity epidemic.

Antibiotics and Weight Gain : A study published in the International Journal of Obesity has finally confirmed a link between antibiotics and weight gain in children. Records of pediatric exams from 2001 through 2012 of over 160,000 children aged 3 to 18 showed that some 30,000 children, who were prescribed antibiotics seven times or more, had gained 3 pounds by age 15 compared to the children who had received no antibiotics. "Not only did antibiotics contribute to weight gain at all ages, but the contribution of antibiotics to weight gain gets stronger as you get older," said Dr. Brian S. Schwartz, the lead author and a professor in the department of environmental health sciences at the Johns Hopkins Bloomberg School of Public Health. [http://well.blogs.nytimes.com/2015/10/21/frequent-antibiotics-may-make-children-fatter/?_r=1]. The news capsule also refers to a study of 10,000 Danish school children in which it was found that usage of antibiotics by women during pregnancy increased the risk of overfat for the children.

???

And superfluous antibiotic prescription appears to be a common feature as Centers for Disease Control and Prevention (CDC) discovered in its study of prescriptions written during 2010-2011. Nearly 30% (47 million) prescriptions for antibiotic were deemed to be unnecessary; these included antibiotics "for acute respiratory conditions, such as sinus infections, middle ear infections, sore throats, colds, bronchitis, bronchiolitis, asthma, allergies, influenza, and viral pneumonia." This means that not only the unnecessary antibiotics are helping to develop resistant strains of bacteria, but they are also contributing to obesity, primarily in children.

Scientists have known for decades that antibiotics

induce weight gain in animals. A 1994 cover story in *Newsweek* reported that U.S. farmers are the biggest consumers of antibiotics in USA, feeding up to 80 different types of antibiotics to cows. Sixty-four antibiotics could even be detected in milk sold in the supermarkets.

Suggestion: Given the huge proportion of calories (perhaps 35% or so) reportedly consumed by Americans from dairy, actual detection of antibiotics in milk, and the professed antibiotic link to weight-gain, I think studies are needed to evaluate the contribution of antibiotics found in dairy products, if any, to the globesity epidemic.

Thyroid disorders

Among hormonal disorders, inadequate production of thyroid hormone has been linked to diminished metabolic rate. The resultant decrease in vigor induces lethargy and a sluggish burning up of calories especially during sedentary hours. Bernadette Biondi of University of Naples, Italy, cites studies dating back to 1984 to "support the clinical evidence that mild thyroid dysfunction is linked to *significant* [Italics added] changes in body weight and likely represents a risk factor for overweight and obesity" [The Journal of Clinical Endocrinology & Metabolism. Online edition July 02, 2013; http://press.endocrine.org/doi/full/10.1210/jc.2010-1245].

7. Insufficient Sleep and Obesity

During sleep the metabolism slows down. Lack of sleep keeps the metabolic rate going at the normal tempo for longer time. Causes of loss of sleep range from workaholic patterns to entertainment pursuits including TV & internet. Longer waking hours typically result in consumption of additional snacks and soft drinks or alcoholic beverages adding unwanted calories. In numerous studies, lack of sleep has been linked to an increase in body weight. A New Zealand study authored by Prof. Ed Mitchell of the University of Auckland reported, "Short sleep duration was associated with a three-fold increased risk of the child being overweight or obese. This effect was independent of physical activity or television watching," that is, the study subjects gained weight on account of fewer hours of sleep irrespective of how much time they spent in physical activity or in watching TV [Science News, ScienceDaily Jan. 1, 2008; http://www.sciencedaily.com/].

Scientists at the Johns Hopkins Bloomberg School of Public Health have found that "children with the shortest sleep duration had a 92 percent higher risk of being overweight or obese." Senior author, Dr. Youfa Wang pointed out that their analysis also confirmed the association of sleep with obesity in the reverse direction, that is, "The risk declined with more sleep" since a supplementary hour's sleep reduced the risk of weight gain by 9 percent. [*Is Sleep Duration Associated with Childhood Obesity? A Systematic Review and Meta-analysis*, by Xiaoli Chen, May A. Beydoun and Youfa Wang; *Obesity*, February 2008].

Dr. Xianchen Liu of the University of Pittsburgh presented findings of a study at the 22nd Annual Meeting of the Associated Professional Sleep Societies involving 335 seven to seventeen years old children and adolescents. "One hour less of total sleep increased the odds of overweight by about two-fold…" reported Dr. Liu. [Science News, ScienceDaily, Feb. 7, 2008; http://www.sciencedaily.com/]. Case Western Reserve University researchers Patel & Hu came to the same conclusion. After a review of 23 studies, they concluded, "Short sleep duration appears independently associated with weight gain, particularly in younger age groups." [*Short sleep duration and weight gain: a systematic review* by Patel S.R. and Hu F.B.; Obesity (Silver Spring). 2008 Mar;16(3):643-53. Epub 2008 Jan 17].

Chapter 3

Obesity Solutions

Important caveat : Narrative in this chapter is based on personal experience, documented research, folk remedies, and common sense.

The contents of this chapter, however, do not provide medical advice and should not be so interpreted. Should you like to pursue any of the routines described herein, see your health professional for clearance.

> The doctor of the year 2014 will work shoulder to shoulder with the teacher. He will see to it that education shall train and develop the whole child, instead of just the expanded bulb at the top of him, leaving the rest of him to shift for itself in the intervals that remain. The new medicine will make schooling a thing of the open air instead of stuffy rooms, of fields and gardens instead of printed pages, of deeds instead of words.... Perhaps by 2014 teachers may recognize that it is as important for a child to correctly bound and describe his liver as the countries of Europe, or the States of the Union, and to know at least as much of his own interior as he does of that of Hindustan. Education for life will include a sound, working knowledge of the body machine that he has to live and work with; of what food fuels will best and most economically supply it with energy; how its bearings are to be watched and its gears regulated; and how to make roadside repairs.
>
> – Woods Hutchinson, A.M., M.D. (1862–1930)
> [from *Civilization and Health*, 1914
> "Chapter II: The Dawn of the New Doctor,"]

Two papers in *Journal of the American Medical Association* by researchers from the Centers for Disease Control and Prevention (CDC) of the United States Government "show that efforts to encourage Americans to lose weight — at least to stop putting on more weight — are having little effect", reports Maggie Fox for NBC News on June 7, 2016, adding that 38% of adults and 17% of teenagers are now obese. [http://www.nbcnews.com/health/health-news/america-s-obesity-epidemic-hits-new-high-n587251] This seems to be in line with a similar report for children by researchers from Duke and Wake Forest Universities of North Carolina who found that "among chil-

dren from infancy through age 18, rates of obesity have increased *steadily* [italics added] from 1999 to 2014, and the numbers of children with the severest forms of obesity have risen most dramatically." This discovery has put dampers on a two year old ray of hope generated by findings of a significant drop in obesity rates in 2-5 year olds in an earlier report. Duke University's Ashley Skinner, the lead author, said that this continuing surge "will require changes across the board – food policy, access to healthcare, school curriculum that includes physical education, community and local resources in parks and sidewalks.. a lot of things put together can work." [Melissa Healy in Los Angeles Times April 25, 2016].

But the United States is not alone in the rise in obesity. A survey of 188 countries published in the medical journal *Lancet* in 2014 found that worldwide 2.1 billion people (nearly 30% of world population) had become overweight or obese and that none of the countries had been able to lower obesity rate since 1980. [Maggie Fox, http://www.nbcnews.com/health/diet-fitness/whole-world-getting-fatter-new-survey-finds-n115811]

What this portrays is that despite a lot of information floating around and unprecedented efforts underway to curtail obesity by citizen groups and the governments, there seems to be no curbing of the juggernaut of overweight and obesity.

What can be done to curb obesity?

I think, first and foremost by implanting priority for health in our surface consciousness.

We squander health in search of wealth.
We scheme and toil and save,

then squander wealth in search of health
and all we get is a grave.
We live and boast of what we own,
We die and only get a stone.

– Anonymous

The above poem very aptly reflects the actual mindset in society today. One thinks of the body only when something goes wrong. The overwhelming stress of society on acquisition of money for its own sake pushes the awareness for health farther in the background. One drives oneself ceaselessly to fulfill demands of study or the job in order to amass utmost pecuniary gain. If that involves giving up sleep, leaving insufficient time for physical activity or otherwise neglecting care of the body, so be it, we are tacitly encouraged to believe. For, when one is young, the vitality (life-force) is still plentiful and this exuberance makes one believe that one is healthy.

What is the difference between vitality and health?

One of the crucial reasons that people in general and youngsters in particular give insufficient attention to health is because they are prone to be confused about two quite different body traits, HEATLH and VITALITY.

Vitality (the life-force) is something we are born with. Old scriptures from India say that 'everyone is born with predetermined number of breaths.' This notion means that by living a healthy life one could slow down the breathing rate (and hence the metabolic rate) and increase the duration of life-force in terms of the

span of life, or conversely an unhealthy lifestyle could shorten the life-span. This notion to a certain extent is supported by scientific research as can be inferred from the following study.

J.W. MacArthur and W.H.T. Baillie of the University of Toronto Department of Biology found that "nearly the same total number of heartbeats (some 15,400,000) occurs in a daphnid's (*Daphnia magna*, the common fruit-fly) life, regardless of temperature or sex.... It is the tempo of life or rate of energy expenditure which determines aging of organisms." [Metabolic Activity and Duration of Life, *J.Exp.Zool.* (1929) 53, 221-268] The following table encapsulates their findings:

Temperature (degree C)	Heart rate (beats/second)	Life span (days)
8	1.69	105
18	4.26	42
28	6.84	26

It is well known that heartbeats and breathing rate are closely linked in a direct relationship.

This is not to say that the number of breaths for all living beings of a species is the same, but it does give a pointer to the correlation between the rate of energy expenditure and the life span. Other examples of this kind of correlation accessed from the internet are:

Animal	Breaths/min.	Life-span (years)
Mouse	60–230	1.5–3.0
Rabbit	30–60	5.0–6.0
Monkey	30–50	20–30

Human	12–16	70–80
Whales	3–5	more than 100
Giant Tortoise	4	200-300

Health on the other hand, is summarily defined as 'the state of being free from illness or injury.' World Health Organization (WHO) gives a more elaborate definition: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity."

Note the *complete .. well-being* in the WHO definition. Many children today are hyperactive. They have lots of vitality, but are they healthy? Many others are quite functional without being completely well. And as was brought out through examples above, vitality without health will not be a long-lasting phenomenon. And even the troubled and shorter life may turn out to be a chore for, as Thomas Carlyle said, "Ill-health of the body is defeat."

So, how to implant the importance of health in the human psyche?

Along with the distinction between vitality and health, a second notion of the imperative necessity of health as a primary contributory factor to happiness has also to be firmly implanted in the human psyche. For as Ben Johnson draws attention to the truism: "there is no enjoying this world without health."

Replace 'Out of sight, out of mind' by 'Ever In Sight, Ever In Mind'

There are two segments of memory that are relevant to our purpose. Surface memory, and subcon-

scious ('unconscious' of Freud) memory. The phrase, 'out of sight, out of mind' generally refers to the lost awareness in our surface mind: "The idea that something is easily forgotten or dismissed as unimportant if it is not in our direct view." The incessant barrage of ads and commercials counters this attribute by replacing it with, "seeing is believing". For example, processed-food giants utilize both kinds of memory for promotion of their products. Through catchy phrases & attractive getup and cartoon characters & celebrities, they rivet our attention to their products, and then through constant onslaught of audio-visual repetitions keep their products in our 'sight'. Repetitions about the relentlessly advertised products sink down in to the subconscious memory even when we are not paying attention. For instance, when you see a logo of a soft drink on a billboard or hear its repeated promotion on the radio while traveling on the road, you don't consciously pay attention to the logo or audio-ad after the first few times or do so only sporadically. Nevertheless, these impressions in totality sink down in to the Subconscient, and stack up as supplementary layers in the obscure subconscious memory.

As referred to in the preceding chapter, Professor Gerald Zaltman of Harvard School of Business in collaboration with Stephen Kosslyn, professor of psychology, found that "consumers choose which products and brands to buy almost entirely subconsciously" and "when it comes to shopping, what people say and think are very different from what they actually do. There are unconscious processes at work." [Jonathan Leake in *The Sunday Times*, August 8, 1999].

These unconscious (or subconscious) processes, however, instigate not only the shopping decisions but, in fact, most of our actions. The great 20th century visionary, philosopher, mystic & yogi Sri Aurobindo enlightens us farther about the 'unconscious processes' as follows: "the conscious operation of mind is only a surface action. There is a much vaster and more potent subconscious mind which loses nothing of what the senses bring to it; it keeps all its wealth in an inexhaustible store of memory… The human like the animal mind lives largely in impressions rising up from the subconscient… The subconscient is a concealed and unexpressed inarticulate consciousness which works below our conscious physical activities… [It] is made up of impressions, instincts, habitual movements .. [which] can be brought up to the mind or come of itself… The action of the subconscient is irrational, mechanical, repetitive. It does not listen to reason or the mental will."

I think we are all aware of the importance of health, but as long as functional vitality is not hampered, that awareness is covered up by a myriad of other activities and interests. What is needed, therefore, is a way to firmly implant the 'importance' of health and hazards of obesity in our psyche such that they will be 'EVER IN SIGHT, EVER IN MIND', through a process not dissimilar to the one so effectively pursued by the 'not so good' food industry.

How to do it?

It is obvious that the financial resources of governments, individuals and do-gooder institutions for publicizing these kinds of messages are too meager and can-

not approach even a small fraction of resources of the processed-food industry and other vested-interest entities which can and do spend billions of dollars for promotion of their products. Therefore, as has been frequently advocated by experts, the solution lies in universal participation of schools to serve as the pivotal nexus for this endeavor.

Recognizing the unrivaled contribution schools can make in arresting the obesity trend in the American populace, the United States 'Surgeon General's Vision for a Healthy and Fit Nation' 2010 report has issued detailed recommendations for the schools to follow. These include for each school to form a health council, encompass "a planned and sequential health education curriculum for pre-kindergarten through grade 12", to exhort teachers and staff to be healthy role models, to promote healthy eating practices through "presentation, marketing, and education techniques", and to ensure allotment of 150 to 225 minutes per week for physical education and activities.

Shelley McGuire of Washington State University writing for the 'Institute of Medicine Report 2012' recommends: "Make schools a national focal point for obesity prevention. Government entities were urged to work coordinately with parents, teachers, and the business community to make educational facilities more accessible and effective centers for health enhancement." And the prestigious journal *Pediatrics* lays down that "Efforts must begin early in life [that is, at the schooling age], because obesity in childhood, especially among older children and those with more-severe obesity, is likely to persist into adulthood." [Pediatrics Vol. 120 Supple-

ment December 2007, pp. S164-192]

To instill the importance of health, a beginning can be made by displaying simple, succinct and catchy phrases, or actual quotes from respectable people and sources at numerous locations, in fact wherever possible, such as:

O health ! health ! the blessing of the rich! the riches of the poor! who can buy thee at too dear a rate, since there is no enjoying this world without thee?

– Ben Johnson, *Volpone, II*

Health and good estate of body are above all good.

– Bible, *Ecclesiasticus 30:15*

Health is the greatest of human blessings.

– Hippocrates

The best of all gains is health.

– India's ancient epic *Mahabharata*

Take care of your body. It's the only place you have to live.

– Jim Rohn

Health is the greatest of all possessions; a pale cobbler is better than a sick king.

– Isaac Bickerstaff

Get Health. No labor, effort nor exercise that can gain it must be grudged.

– Ralph Waldo Emerson

Ill-health of body or of mind, is defeat. Health alone is victory.

– Thomas Carlyle

He who enjoys good health is rich, though he knows it not.

– Italian Proverb

He who has health, has hope; and he who has hope, has everything.

– Arabian Proverb

A healthy family is sacred territory.

– Anonymous

Printed placards/posters of these messages can be pinned to the walls in classrooms, corridors, gymnasiums, sports arenas, washrooms, etc.; in fact, any place they can catch the eye evoking remembrance of 'health' in surface memory and leaving impressions in the subconscient memory. Children can also be encouraged to hang or paste these kind of posters in those locations in their homes where they will be most noticeable.

Governments can undertake to get such posters printed and displayed prominently in all feasible locations including offices and corridors of public buildings. Airports, train stations, bus terminals, state aided colleges and Universities, etc. Other locations requiring minimal or no rent can also be identified and made use of for such displays. Surely, many inexpensive ways can be devised to implant the kernel of these messages in our subconscious and surface consciousness.

Concurrently with this effort, a second step is to enhance awareness of deleterious effects of 'OBESITY' on our daily life through a display of messages, such as:

Obesity INCREASES RISK of

Diabetes
Heart & Lung disease, stroke
Multiple cancers
Gall-bladder, liver disease
Bone & Joint problems

Depression, mental health problems

– Weight-control Information Network, NIH, US Govt.

Obesity hazards

Scientific evidence links 15 serious health conditions to obesity, including:

- Asthma
- Diabetes
- Gallstones
- Heart disease
- High blood pressure
- Cholesterol and triglyceride problems
- Liver problems
- Menstrual problems
- Trouble sleeping

Children with 1 obese parent : 50% chance of obesity
Children with 2 obese parents : 80% chance of obesity

– University of California at San Francisco Benioff Children's Hospital

Form 'rational bonding' to healthiness and 'rational aversion' to dis-ease

As was discussed earlier, what processed-food industry does is to use multiple tools – catchy phrases, cartoon characters, celebrities, attractive packaging, sports sponsorship, competitions & rewards, and a host of other gimmicks & devices appealing to the feelings of liking, admiration & adulation, obligation, gratitude, to bolster 'emotional-bonding' to their products.

If the actual worth of their products were to be exposed through bundles of authentic information threaded into sequentially cohesive knowledge addressed to the reasoning faculty, much of the glamour is likely to be superseded by the true appreciation of the product's

deleterious effect on human health. For human beings are blessed with a brain and its reasoning power, a faculty higher than emotions. "Reason… is the understanding power of his nature… [which] approves and sets its sanction on one or other among the many suggestions of his complex instincts, impulsions, ideas and desires. It is that which determines for him what is right or wrong, to be done or not to be done" wrote Sri Aurobindo.

What can perhaps be done is to devise processes which can be contextually termed as 'rational-bonding' to health & healthy pursuits by influencing the intellect instead of emotions, and by cementing a conviction through REASON, the highest mental faculty available to human beings. This can perhaps be illustrated by a real-life example**:**

Sri Aurobindo Ashram-Delhi Branch conducts week long 'adventure youth camps' in the Indian Himalayas. I used to give 30 minute talks to each group of 100+ youngsters on nutrition and health. First, I would enumerate how important health was to a joyous life. Does one enjoy life when sick or afflicted with a disease? No matter how much money one has, can one eat sweets with impunity if one has diabetes, or can one enjoy uphill walking or treks in beautiful mountainous terrains if one has asthma, etc.? Rather one becomes frustrated, miserable and depressed realizing that despite possessing plenty of monetary resources one could not indulge one's fancy as other's can, in many fields, because one is unhealthy.

Secondly, targeting soft drinks, for instance, I would itemize soft-drink ingredients – sugar, acidity on pH scale,

caffeine – and elaborate on what each ingredient does when consumed in excessive amounts to human body in terms of fostering obesity, diabetes, decayed teeth, bone maladies, etc. I would ask rhetorically : do you know how sugary drinks cause obesity? And then would explain: sugar is a simple carbohydrate unit. Unlike complex carbohydrates (starch, etc.), it starts circulating in your blood almost immediately on consumption. The hormone insulin is produced quickly to enable excessive sugar to penetrate into the cells. Even a slight overproduction of insulin induces greater mopping up of glucose from the blood than the essential basal level required for normal functioning of the body. Low blood sugar results in a feeling of decreased energy in the body thereby stimulating a craving for more sugary products provoking a roller-coaster of blood sugar. Unless excess calories are burnt by supplemental exercise, this leads to obesity and diabetes over time by stressing & damaging the beta cells of the pancreas due to a repeated on-off cycle of insulin production.

In a similar vein, I would explain how & why soft-drinks can lead to teeth and bone disorders. Human blood maintains a pH value of 7.35–7.45. Soft-drinks generally have a pH of around 3. pH are units of measurement of acidity and basicity. pH scale readings are between 0–14. It is a logarithmic scale, which means that each unit represents a 10-fold increase or decrease. pH of 7 signifies neither acidic nor basic, that is neutral. Numbers below 7 and dropping towards 0 mean increasing acidity with 0 denoting total acidity. Readings above 7 denote increasing basicity with 14 signifying total ba-

sicity. Since blood pH is near 7.4, it is slightly basic. It is a medical fact that lowering of blood pH to 7 or below results in coma, whereas pH of 7.8 and above causes loss of muscle control. Hence the body strives to neutralize excess acid promptly by minerals. The most abundant source of mineral in the body is calcium in the bones. Excessive consumption of soft-drinks leaches out calcium from the bones leading to osteoporosis and weakening of bones. Growing children are at greater risk of calcium loss because their blood volume is small compared to adults and hence the same bottle/can of soft-drink will threaten to engender higher acidity in their blood.

Teeth are made up of inorganic salts (mineral salts) which can erode through the action of acid in the soft-drinks.

Majority of soft-drinks contain caffeine. Though not conclusively proven, many researchers contend that caffeine is mildly addictive. Certainly regular consumers of tea and coffee feel much at dis-ease if deprived of their customary potion(s). I used to point out that recurrent craving for soft-drinks may also be due to caffeine dependence.

I have had occasion to meet participants of those camps years, sometimes over two decades, later who told me that that one specific talk *convinced* them of the deleterious effects of soft drinks on health, and that they have taken pains to limit intake of soft drinks at most to 1 or 2 in an entire month ever since!

I certainly am not a mesmerizing orator. It seems to me that my half hour talk was so effective only because

the participants already knew deep down that healthwise these drinks are in the category of 'not so good' foods. What the talk did achieve, however, was to form a 'rational-bonding' to the truth of the 'not so good' label attached to the soft-drinks and their deleterious effects on health. Those lucid arguments based on scientific studies powerfully appealed to their *Reason* and resulted in a conviction. And what is conviction if not a dynamic belief which practically always instigates a behavioral response?

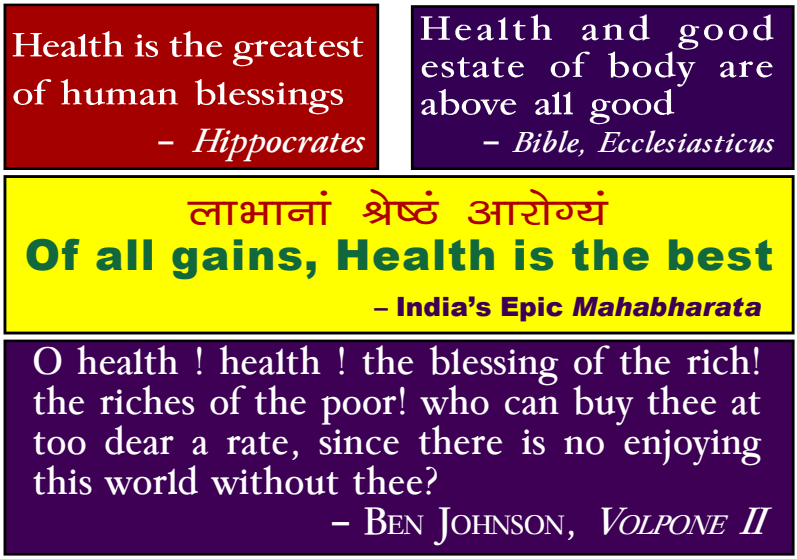
Information is NOT knowledge

People generally have cursory knowledge about health. Although copious information, thanks to the internet, is available about almost anything under the sun; one, it does not register out of context, and two, if the information bundles are not put together in a cohesively sequential manner with a cause, effect, and mechanism of process relationship, no rational inference will be drawn and the info just becomes so many wisps of air without any tangible impact on understanding let alone behavior.

I believe the key to cement rational bonding is to give explanations at each step so that the intellect is able to grasp the 'why' and 'how' (questions children are always asking) of the process. "Knowledge is the concise and appropriate collection of information in a way that makes it useful... To get knowledge you need some cognitive and analytical ability while for information you do not need cognitive ability." [http://www.differencebetween.net/language/difference-between-knowledge-and-information/]. A similar approach is recommended in

the psychological study published by H. Jang of University of Wisconsin at Milwaukee. "One way teachers can help students value what they may deem "uninteresting" is by providing a rationale that identifies the lesson's otherwise hidden value, helps students understand why the lesson is genuinely worth their effort, and communicates why the lesson can be expected to be useful to them. [*"Supporting students' motivation, engagement, and learning during an uninteresting activity"*. Journal of Educational Psychology. **100** (4): 798–811].

Hence it should be even better if children in small groups of 4-5 in their 'health education' class were encouraged to search & retrieve most of the information from the internet themselves and put the bundle together in creating succinct plaques and posters. As part of their art/drawing class, they can also make them attractive and eye-catching by embellishing the posters with colors, drawings, paintings, pictures, graphics, etc. A sort



Take care of your body. It's the only place you have to live
– *John Rohn*

He who enjoys good health is rich. Though he knows it not
– *Italian Proverb*

Obesity INCREASES RISK of :

Diabetes

Heart & Lung disease, stroke

Multiple cancers

Gall-bladder, liver disease

Bone & Joint problems

Depression, mental health problems

– Weight-control Information Network, NIH, US Govt.
[http://www.win.niddk.nih.gov/]

Obesity hazards :

Scientific evidence links 15 serious health conditions to obesity, including:

- Asthma
- Diabetes
- Gallstones
- Heart disease
- High blood pressure
- Cholesterol and triglyceride problems
- Liver problems
- Menstrual problems
- Trouble sleeping

Children with 1 obese parent : 50% chance of obesity
Children with 2 obese parents : 80% chance of obesity
– University of California at San Francisco Benioff Children's Hospital

Soft-drinks link to diabetes:

1. Energy in body is provided by breakdown of carbohydrates: simple (sugar), complex (starch).
2. Carbohydrates are converted to glucose.
3. Simple carbohydrates are converted to glucose fast, conversion of complex is slow.
4. Basal levels of glucose circulate in blood for providing energy for normal body functions.
5. Excessive sugar from soft drinks raises blood glucose level suddenly.
6. Pancreas has to produce insulin which makes absorption of glucose in to cells possible.
7. Hasty manufacture of insulin can result in over-production of insulin.
8. Extra insulin makes blood glucose to drop below basal level.
9. Low blood sugar induces craving for chocolate, sweets, soft drinks.
10. Consumption of sweet things begins the cycle of hasty insulin production again, and so on.
11. Stressed pancreas cells gets damaged leading to diabetes.

Soft-drinks link to bone disorders

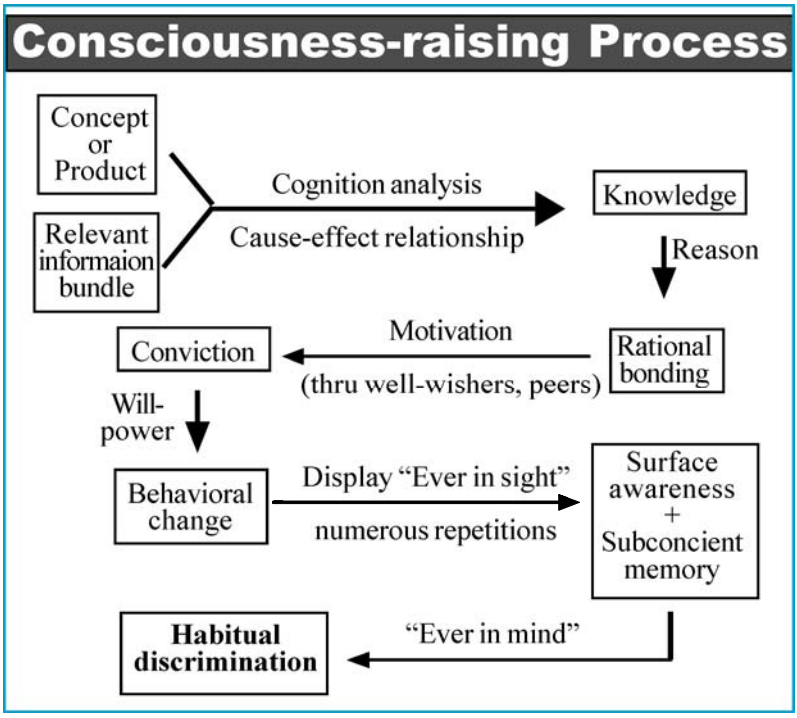
1. pH of blood – maintained between 7.35 to 7.45.
2. pH scale (0-14) gives parameters of acidity and basicity. It is a logarithmic scale, in which each unit represents a 10-fold increase or decrease. A pH reading of 7 is neutral; below 7 acidic; above 7 basic. This signifies that blood is slightly basic.
3. At pH 7 or less coma ensues.
4. Above 7.8 muscle control is impaired.
5. Popular soft-drinks have pH of about 3. This means that they are 10,000 times or more acidic (a difference of 4 in pH reading will equal 10x10x10x10).
6. Body neutralizes excess acid by minerals.
7. Excessive consumption of soft-drinks induces leaching out of calcium from the bones, the most abundant source of minerals in human body.
8. Thus frequent intake of soft-drinks may lead to osteoporosis and weakening of bones.

of competition can be organized every week/month and the best adjudged plaques/posters be displayed at the most prominent locations in the school and elsewhere and the students be commended for their creativity. Help of teachers in the 'Health period' can be utilized for analyzing the information and linking the info-bundle in sequential cause-effect relationships to derive inferential knowledge. Even as they are engaged in preparing this material, the gist will surely sink down in to their psyche furthering the formation of 'rational bonding'.

A few working examples of plaques & posters of these in color were given above.

In conclusion, an **important step in tackling the problem of obesity** can be made through 'rational bonding' to the notions of health & 'aversion to disease' by the technique of an ubiquitous display of appropriate 'ever in sight, ever in mind' candid messages about 'importance of health' and 'dangers from obesity'. Children can gather information about benefits from sound health and hazards from obesity from the internet themselves. In the 'health education' class interactive discussions guided by teachers about the difference between health and vitality, dangers to a normal happy & fruitful life from obesity with examples of healthy and obese people, role of health to academic excellence and career boost up, and contribution to the well-being of family and society, etc. Human beings are mental beings, and a rational explanation & concept should lead to a 'rational bonding' by appealing to 'reason.' The goal is to arrive at an ever-present insight which weighs not only actions but even thoughts & impulses against a barometer of health, a **habitual discrimination**. Succinctly put, this process comprises of the following steps (see chart on the next page):

A habit is an automatic response or mode of action and good habits have great utility in a continuity of sound patterns of behavior. Habits also appear to be Nature's device to conserve energy, for it is well known that decision-making is an energy intense process which in excess could be stressful to the human system. For instance, President Barrack Obama said in an interview once that he wears only gray or blue suits because he wants to cut down decision-making for mundane things



since those adversely affect the "too many other [important] decisions [he has] to make" and also "mentioned research that shows the simple act of making decisions degrades one's ability to make further decisions." Habits over time practically turn in to personality traits and become ingrained almost akin to instincts in animals and human beings.

So what would 'habitual discrimination' in context of health accomplish?

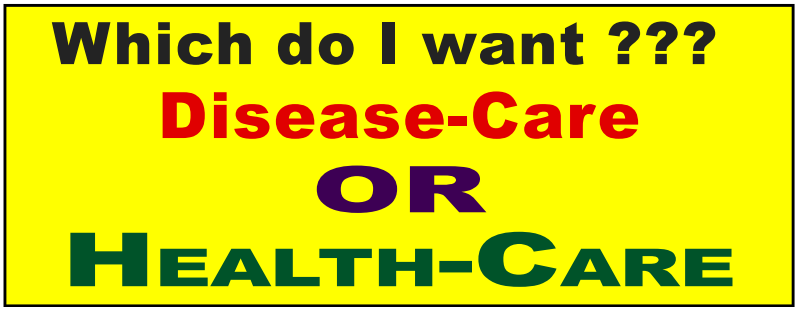
There are people, sometimes mockingly but also enviously called health-nuts, who have imbibed this trait in their psyche. They will read labels on all product containers, eat whole organic foods as far as feasible, leave

early from parties to avoid losing needed amount of sleep, avoid questionable gadgets such as microwave ovens and overuse of mobile phones, be regular in physical activities so much so that they will carry out their walking indoors in nasty weather, will take every opportunity to walk or bike short distances and use stairs instead of lift/elevator, minimize use of harmful cosmetics or personal care products including chemicals & not so useful medications, etc. For them routine discrimination in all matters related to health has become a characteristic trait of their innate being.

And for them 'health' will be at all times:

'Ever in Sight, Ever in Mind'

And that is precisely what is needed to be inculcated in children by 'health education' right from the school going age.



Obesity

Simultaneously with efforts to inculcate a trait of 'habitual discrimination' specifically about health, awareness of obesity ought to be made precise in children's psyche.

In each classroom can be placed a digital weighing machine, and a measuring tape in inches & centimetres affixed to the wall, for children to determine their weight and height. Teachers can provide help whenever necessary.

Measuring Weight

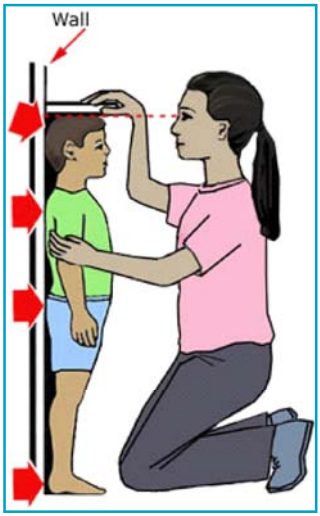
To measure weight accurately at home to calculate BMI-for-age:

1. Use a digital scale. Place the scale on firm flooring
2. Have the child or teen remove shoes and heavy clothing, such as sweaters.
3. Have the child or teen stand with both feet in the center of the scale.

4. Record the weight to the nearest decimal fraction (for example, 55.5 pounds or 25.1 kilograms).

Measuring Height

1. Remove shoes, bulky clothing, and hair ornaments, and unbraid hair
2. To stand on uncarpeted floor against plain wall
3. To stand with feet together & flat, and against the wall; legs straight, arms at side, and shoulders are level.
4. To look straight ahead, no tilt in head
5. As far as possible, head & shoulders & buttocks & heels ought to touch the wall (See illustration.)



[Adapted from: http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/measuring_children.html]

6. Use a flat headpiece to form a right angle with the wall and lower the headpiece until it firmly touches the crown of the head.
7. Make sure the measurer's eyes are at the same level as the headpiece.
8. Lightly mark where the bottom of the headpiece meets the wall. Then, use a metal tape to measure from floor to the mark
9. Accurately record the height to the nearest 1/8th inch or 0.1 centimeter.

Students should be encouraged to calculate their own BMI after determining parameters of weight and height by the simple formulas given below (both in U.S. Customary Units: pounds & inches; and Metric Units: kilogram & meters or centimeters). For example:

United States Customary System

$$\text{BMI} = \frac{\text{Body weight in pounds x 703}}{\text{Height in inches x height in inches}}$$

Example– weight: 105 pounds; height: 58 inches

$$\text{BMI} = \frac{\text{105 pounds x 703}}{\text{58 inches x 58 inches}} = \frac{73{,}815}{3{,}364} = 21.94$$

Metric System

$$\text{BMI} = \frac{\text{Body weight in kilograms}}{\text{Height in meters x height in meters}}$$

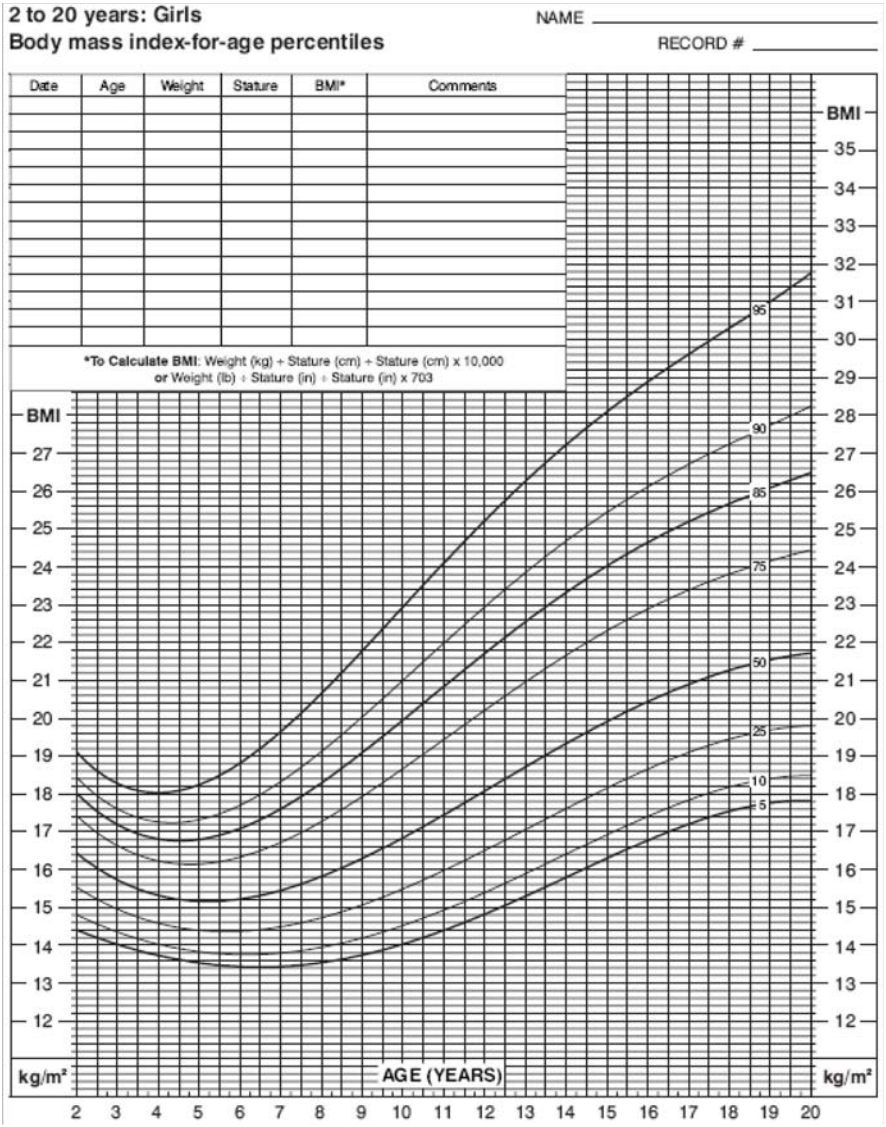
Example– weight: 61 kg; height: 1.4 meter (140 cm)

$$\text{BMI} = \frac{\text{46 kilograms}}{\text{1.4 meters x 1.4 meters}} = \frac{61}{1.96} = 31.12$$

BMI values can also be read from pre-calculated tables available from internet, for instance, websites of World Health Organization (WHO) or Centers for Disease Control and Preventions (CDC), but the process of calculation itself will enhance awareness about BMI and what it represents.

It was explained in the first chapter that the BMI

Percentile Range	**Weight Status Category**
Less than 5th percentile	Underweight
5th-84.9th percentile	Normal or Healthy Weight
85th-94.9th percentile	Overweight
95th or more percentile	Obese



http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

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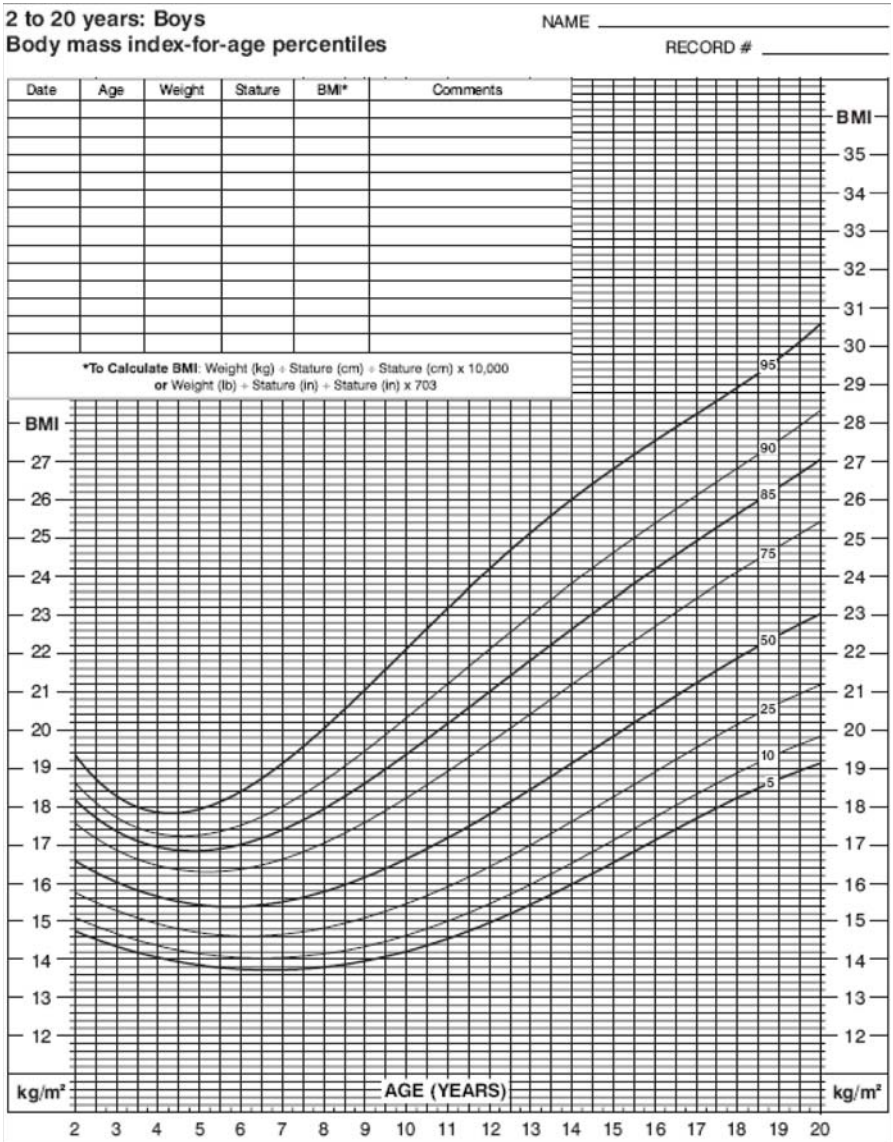

http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

values for children have to be interpreted differently from adults because they are still in a growing phase. Separate charts for girls and boys are available for interpretation (given on the preceding pages). A third chart with boys 2-20 years examples also is appended subsequently. As you can observe, percentile reading for a 10 year old girl (chart on page) and a 10 year old body (chart on page) differ slightly. This means that based on gender the same BMI value for identical age may place a child in a different weight-status category.

After determining their own BMI value, children can find out their own 'weight status' from the charts. They can be encouraged to maintain a record of their 'weight status' on specified days fortnightly or monthly. Having this facility available right in their classroom should also boost up opportunities for discussion about body weight among children thus keeping obesity awareness 'ever in mind.'

Nutrition

A healthy eating pattern includes:

- A variety of vegetables from all of the subgroups—dark green, red and orange, legumes (beans and peas), starchy, and other
- Fruits, especially whole fruits
- Grains, at least half of which are whole grains
- Fat-free or low-fat dairy, including milk, yogurt, cheese, and/or fortified soy beverages
- A variety of protein foods, including seafood, lean meats and poultry, eggs, legumes (beans and peas), and nuts, seeds, and soy products
- Oils

A healthy eating pattern limits:

- Saturated fats and *trans* fats, added sugars, and sodium

– US Department of Agriculture Food Policy 2015-2020

What should we eat?

A lot of tangential opinions about what should we be eating to curb the globesity epidemic are going around for the past few decades. United States Department of Agriculture (USDA) Food Policy 2010 and its successor Food Policy 2015-2020 exhort the populace to consume more vegetables and fruits; whole grain products should preferentially replace products prepared from refined grains.

Vegetarian vs. Non-vegetarian foods

What is noteworthy in the above USDA recommendations is the duplication of legumes which are not only vegetable items but are also recommended as

sources of protein foods.

I hope that a personal note will not be remiss in this context. I first reached the United States in 1973 and began working as a research associate at the Ohio State University in Columbus, Ohio. Those were days when the novel food co-op movement was beginning to establish a foothold in America during the Vietnam War era. I used to work a few hours a week at the 17th Avenue Food co-op where in conversation, a customer cautioned me that being vegetarian perhaps worked for me in India but here in the USA if I stuck to that diet I will end up in a hospital within six months implying that vegetarian food does not provide required nutrition. Of course, I was sceptical of his prognosis since I knew that countless generations in my family before me had never partaken non-vegetarian food and were reasonably healthy and reasonably long-lived (2 grandmas till theirs 80s and 1 grandpa past 100).

According to USDA, "Grain products, vegetables, and fruits are key parts of a varied diet. They are emphasized in the Guidelines because they provide vitamins, minerals, complex carbohydrates, and other substances that are important for good health. They are also generally low in fat, depending on how they are prepared and what is added to them at the table."

Now USDA is practically implying that a vegetarian diet is better for you. How things have turned around !!

Could a predominantly vegetarian diet be better in context of the obesity epidemic?

Well, to recapitulate from the chapter 'Causes of Obesity', foods consist of the following nutrients and

associated energy:

* Carbohydrates (simple & complex variety) – 4 calories per gram (1oz=28g)
* Proteins – 4 calories per gram
* Lipids (commonly known as oils or fats) – 9 calories per gram
* Dietary Fiber – 1.5 to 2.5 calories per gram
* Alcohol – 5.5 calories per gram
* Water – 0 calorie

[Calories referred to here were explained in the chapter 'Causes of Obesity']

In the most simplistic terms, disparity in energy density [concept of Energy Density, ED, was explained at length in the chapter 'Obesity Causes'] among foods is a consequence of varying proportion of nutrients. Carbohydrates, proteins, and fats are the constituents with appreciable amount of calories. Water is calorie free, and fiber has low calorific value; some fibers are indigestible and provide no calories at all. Foods containing significant amounts of water and fiber will, therefore, consist of fewer calories per unit weight.

According to the U.S. Government's Centers for Disease Control and Prevention (CDC): "A number of studies indicate that over the course of a few days, the weight of food a person consumes is fairly consistent and is more consistent than energy intake. Therefore, encouraging people to eat more foods low in energy density and to substitute these foods for those higher in energy density helps them decrease their caloric intake while eating satisfying portions of food and controlling hunger." [https://www.cdc.gov/nccdphp/dnpa/nutrition/pdf/

r2p_energy_density.pdf]

So yes, a vegetarian diet could be advantageous in reducing obesity for it leads to reduced energy intake compared to non-vegetarian foods which contain mini-

Energy Density (ED) of Protein Foods

Food Description	Edible portion	Wt (g)	water %	Cal (kcal)	Total dietary fiber (g)	ED
Beef cooked, lean and fat	3 oz	85	47	293	0	3.45
Beef cooked, lean only	3 oz	85	55	213	0	2.51
Ground beef, broiled 79% lean	3 oz	85	56	231	0	2.72
Chicken fried light meat	3 oz	85	60	163	0	1.92
Chicken pieces, boneless breaded &	6 pieces	106	47	319	0	3.01
Ground beef, broiled 79% lean	3 oz	85	56	231	0	2.72
Fish fillet, battered or breaded fried	1 fillet	91	54	211	0.5	2.32
Hamburger regular size with condiments 1 patty	1 sandwich	106	45	272	2.3	2.57
Meatless burger patty Morningstar Farms	1 patty	85	71	91	4.3	1.07
Beans dry cooked Black	1 cup	172	66	227	15	1.32
Beans, dry cooked, kidney, red	1 cup	177	67	225	13.1	1.27
Beans, dry cooked, Lima large	1 cup	188	70	216	13.2	1.15
Beans, dry cooked,Pinto	1 cup	171	64	234	14.7	1.37
Black eyed peas, dry, cooked	1 cup	172	70	200	11.2	1.16

Adapted from *Nutritive Value of foods USDA hg72_2002.pdf*

mal or no dietary fiber and low proportions of water.

An extremely good source of data for ED calculation can be found in the United States Department of Agriculture's *Nutritive Value of foods USDA hg72_2002.pdf*, which can easily be downloaded through the internet.

A perusal of the calculated EDs of food items in the table below readily demonstrates that meat and fish protein foods contain about double the amount of calories compared to beans & legume protein foods. This means that if 3 oz. (85 g) of beef were substituted by 1/2 cup (86 g) of black eyed peas, then the intake of 85x3.45=293 kcals will be replaced by 86x1.16=100 kcal, a shortfall of 193 kcals, a number of calories to burn which will otherwise require 41 minutes of brisk-walking at 4 mph (6.4 km/p/h) for a 70 kg or 154 lbs. individual.

Veg & non-veg foods: a cost-benefit perspective

Neal D Barnard MD, adjunct associate professor of medicine at George Washington University School of Medicine and Health Sciences and president of the Physicians Committee for Responsible Medicine(PCRM) in Washington, D.C. at the symposium "National Conference on Childhood Obesity," held in Washington, DC, 18-19 June 2009, cited earlier, also blamed animal foods for escalation of health disorders in the American population. Dr. Barnard said that United States Department of Agriculture figures show that from 1909 to 2004, per capita consumption of meat rose from 124 lbs. (56 kg) to 200 lbs. (91 kg), and of cheese from a meagre 4 lbs. (1.8 kg) to 30 lbs. (13.6 kg). These extra meat and cheese amounts "per person per year – have contributed a load

of fat, choresterol and calories..." Summarizing his view, he said that "many .. studies [show] that meaty diets are risky, while plant-based diets are potent for preventing obesity, lipid disorders, and diabetes... Plant-based diets are the nutritional equivalent of quitting smoking... Like smoking, unhealthful eating habits affect the whole family. When parents eat poorly, their children do, too." [http://ajcn.nutrition.org/content/91/5/1530S]

Meat diet: Mortality & Environmental costs

A much acclaimed Oxford University study published in the prestigious Proceedings of the National Academy of Sciences (PNAS) by Marco Springmann and co-workers has shown that "health and climate change benefits will both be greater the lower the fraction of animal-sourced foods in our diets." The authors focused "on consumption of red meat, and of fruits and vegetables...[and] excess calorie consumption." All 3 evaluated diets limit added sugar consumption to 50g or less per person per day (pppd) and a calorie limit 15% lower at 2200-2300 kcal per capita depending on people

Diet	Fruits & Vegetable	Sugar (g)	Red Meat	Calories (kcal)	Pulses (g)
Reference	297	100+	75	2590-2705	19
Healthy Global Diet (HGD)	396	≤50	33	2200-2300	19
Vegetarian	452	≤50	0	2200-2300	80
Vegan	509	≤50	0	2200-2300	80

variables. Reference data for 2050 assume the continuity of present trends in consumption.

Outcomes of the 3 diets compared to reference diet in terms of mortality, life years saved, cost of illness savings, economic benefits due to reduced mortality, and environmental benefits in dollars were calculated, all for the year 2050.

In the Year 2050 :	HGD	Vegetarian	Vegan
Avoided deaths (million)	5.1	7.3	8.1
Life Years Saved (million)	79	114	129
Cost of Illness saving (billion US$)	735	973	1067
Economic benefits due to reduced mortality (trillion US$)	21	28	30
Environmental benefits (billion US$)	234	511	570

Assigning benefits to the components of the three diets, the authors concluded "that about half of the global avoided deaths occurred because of the consumption of *less red meat* [italics added] and that the other half was due to a combination of increased fruit and vegetable consumption and reductions in total energy intake (and the associated decreases in the fraction of people overweight and obese)". [Analysis and valuation of the health and climate change cobenefits of dietary change; http://www.pnas.org/content/early/2016/03/16/1523119113.full].

Avoided deaths were due to :	%
Decreased meat consumption	51-57
Increased fruit and vegetable consumption	24-35
Lower obesity and limiting calorie intake	19-30

A side-bar on the next page draws further attention to environmental costs of meat diets.

Burden of a Meat diet on the planet and environment (Greenhouse Gas emissions)

"It turns out that producing half a pound of hamburger for someone's lunch a patty of meat the size of two decks of cards releases as much greenhouse gas into the atmosphere as driving a 3,000-pound car nearly 10 miles." – Scientific American

"A 2014 British study on the environmental impact of diet concluded that dietary GHG emissions in self-selected meat-eaters are approximately twice as high as those in vegans. The study ran across 2,041 vegans, 15,751 vegetarians, 8,123 fish-eaters and 29,589 meat-eaters and adjusted for gender and age. The findings estimate that meat-rich diets, defined as more than 100g per day, ran the equivalent of 7.2kg of carbon dioxide emissions. In contrast, both vegetarian and fish-eating diets equated to 3.8kg of CO2 per day, while vegan diets produced only 2.9kg."

And of all the non-veg items, red meat, especially beef is the most burdensome: "Sources estimate the production of red meat to dwarf all other livestock on environmental impact, with cattle utilizing 28 times more land and 11 times more water than swine or chicken. Compared to staples such as potatoes, wheat, and rice, the impact of beef per calorie is even more extreme, requiring 160 times more land and producing 11 times more greenhouse gases."

– Referenced in University of California at Berkeley Sutardja Center for Enterpreneurship & Technology's *Saving the Planet The Market for Sustainable Meat Alternatives;* scet.berkeley.edu/wp.../CopyofFINALSavingThePlanetSustainableMeatAlternatives.pdf]

Subsidy vs health: Dichotomy in govt. programs

On one side USDA is exhorting people to eat more fruit and vegetables. On the other side the US government doles out $38 billion in subsidy to meat and dairy industries and *merely US$17 million* to fruits and vegetables. Similarly, Organisation for Economic Co-operation and Development (OECD) countries subsidies for meat and dairy total US$ 53 billion.

In the United States, "a $5 Big Mac would cost $13 if the retail price included hidden expenses that meat producers offload onto society. A pound of hamburger will cost $30 without any government subsidies." Governments in other countries notably the Organisation for Economic Co-operation and Development (OECD members also give substantial subsidies for meat production. "In a way the governments spend our tax money to promote the meat eating habit among the people. If the governments reduce or stop these subsidies the meat consumption will be greatly reduced" thereby resulting in lower calorie intake from energy-dense foods and diminished obesity. "Current programs that subsidize feed grains or provide direct subsidies and other supports for meat or dairy production are at odds with federal health recommendations. From a public health perspective, altering federal agricultural policies is a key part of addressing the epidemics of obesity and poor health among Americans," asserts Physicians Committee for Responsible Medicine.

The advent of plant-based meat substitute products may usher a rather painless transition

Food industry is beginning to respond to the genu-

ine shift in people's psyche from meat based to plant-based food preparations. By developing plant-based products similar to their meat-based counterparts, the industry is attempting to entice customers to these less energy-dense substitutes. Thus the Walmart chain of supermarket stores now carries Morning Star Farms' line of vegetable based meat-substitute products which include veggie burgers, patties, veggie sausages, veggie corn dogs, Hickory BBQ Riblets Veggie Riblets, and the like. [https://www.walmart.com/c/brand/morningstar-farms] Even USDA has included nutritional parameters of the 'Meatless burger patty Morningstar Farms' in its "Nutritive Value of Foods 2002". Meatless burger packs less than half of the calories compared to the hamburger.

Meatless burgers are made from a wide variety of vegetable items such as brown rice, mushrooms, sunflower seeds, carrots, beans, string beans, soy protein concentrate, wheat gluten, water chestnuts, onions, and other vegetables. Matt Frazier in his article, 'The Great Veggie Burger Taste Test' evaluates products from several businesses such as Gardenburger Portabella Veggie Burgers, Sunshine Original Burgers, Bahama Rice Burgers, Boca Vegan Meatless Burgers, Morning Star Garden Veggie Patties, Dr. Praeger's California Veggie Burgers. [http://www.nomeatathlete.com/veggie-burger-reviews/; retr 11 May 2017]

An important player in the meatless burger market, 'Beyond Meat' of El Segundo, California, has developed a burger "made mostly of pea protein, yeast extract and natural oils, has more protein than the traditional burger ... so similar to the classical American burger ... that it's become the first ever plant-based product

sold in the meat department [italics added] at Whole Foods", writes Nick Pachelli in the Los Angeles Times (June 6, 2016).

Such savvy businessmen as Bill Gates, Biz Stone, Seth Goldman and former McDonald's CEO Don Thompson are all reportedly investing in 'Beyond Meat' adds Pachelli. That the trend towards plant-based nutrition is real, and not a fad, is convincingly shown by the investment of the world's largest meat producer, Tyson Foods Inc., in Beyond Meat to the stake of 5%. The company is also furnishing US$150 million as venture capital fund for start-ups in meat substitute enterprises. Tom Hayes, the CEO of Tyson Foods says that "he is now pushing... towards sustainability, plant-based..." protein products. [http://www.foxbusiness.com/features/2017/03/07/tyson-foods-ceo-future-food-might-be-meatless.html]. Google also attempted to buy 'Impossible Foods', makers of meatless burgers sold in the bay area of San Francisco and reportedly growing at a healthy rate in March 2017, for US$300 million but that offer was rejected.

It is also pertinent in a cost-benefit context to mention that the pioneer nutrition & metabolism scientist Wilbur Atwater's "calculations established that wheat flour and dried beans provided energy and protein at a lower cost than did either meat or fruit. This hierarchy of food prices has remained primarily unchanged in more than 120 years." [Adam Drewnowski and Nicloe Darmon, *The economics of obesity: dietary energy density and energy cost*, Am.J.Clin.Nutr 2005;82 (suppl):265S-73S]

Concluding remarks on the shift from meat to a predominantly plant based diet : Numerous recipes for

vegetarian item preparations are available on the net today. Vegetarian food items can be nutritious as well as tasty. Many fried food items can pack a big amount of calories, so be circumspect.

Eat whole foods

Most of the foods consumed in USA and Europe are processed. Allegedly, 90% of food dollars in America are spent on processed food items. In addition to processed foods being high in energy density (as detailed in the chapter, "Causes of Obesity"), processing of foods also removes micronutrients, "which although only required by the body in small amounts, are vital to development, disease prevention, and wellbeing. Micronutrients are not produced in the body and must be derived from the diet" [CDC].

For instance, in the wheat flour refinement process "according to a recent study, about 66% of the B vitamins, 70% of all minerals, 79% of the fiber and about 19% of the protein get removed." In preparation of refined sugar, microminerals chromium, manganese, cobalt, copper, magnesium and zinc are removed from the sugar cane juice. [http://www.copperwiki.org/index.php/Processed_Food]

What are micronutrients?

In addition to the major nutrients: carbohydrates, fats, proteins, fiber and water,– the human body also needs minerals and vitamins. Minerals necessary for human health are sub-divided in to 2 categories: macrominerals are needed in excess of 100 milligram per day and consist of Calcium, Chlorine, Magnesium, Phos-

phorous, Potassium, Sodium and Sulfur.

The label of micronutrients is applied to substances, minerals & vitamins, which are required by the body in minute quantities. The category of micro-minerlas (a.k.a. trace minerals) includes:

- Boron
- Chromium
- Cobalt
- Copper
- Germanium
- Iodine
- Iron
- Lithium
- Manganese
- Molybdenum
- Rubidium
- Selenium
- Silicon
- Vanadium
- Zinc

Whereas the category of vitamins, distinguished by their solubility, includes:

Vitamins, water soluble

- Thiamine (vitamin B1)
- Riboflavin (vitamin B2)
- Pyridoxine (vitamin B6)
- Cobalamin (vitamin B12)
- Folate
- Niacin
- Ascorbate (vitamin C)
- Pantothenic acid
- Biotin

Vitamins, fat soluble

- Retinol (vitamin A)
- Cholecalciferol (vitamin D)
- Tocopherol (vitamin E)
- Phytomenadione (vitamin K)

But, why are micronutrients "vital to development, disease prevention, and wellbeing."

Well, to appreciate the role of micronutrients, let us remember that thousands of chemical reactions are taking place in the body at all times: to break down foods, generate heat & energy, to assemble a variety of cells & tissues, etc. To carry out similar reactions in a modern laboratory would require enormous resources in terms of energy (high temperatures and pressures), reagents, and time. In the human body, however, these biochemical reactions are made possible at ambient temperature (37 degree Celsius or 98.6 degrees Fahrenheit) at a phenomenally fast rate of tens of thousands or hundreds of thousands molecular reactions per second through the catalytic action of a class of compounds, mostly proteins, called 'enzymes. Catalysts facilitate reactions but themselves are not permanently changed and hence one molecule of enzyme, generally specific for each reaction, can help break thousands of molecules to smaller units or instigate formation of thousands of bigger units.

For the most part, microminerals and vitamins act as essential co-factors. For example, zinc is a co-factor for over 100 enzymes in human body and its deficiency is linked to poor appetite, retarded growth, and decreased immunity; chromium is a constituent part of Glucose Tolerance Factor which boosts the effect of insulin in

sugar metabolisn; deficiency of copper containing enzyme ferroxidase leads to anaemia; iron in haemoglobin acts as a carrier for oxygen; molybdenum is a component of the enzyme xanthine oxidase which metabolizes purines to uric acid; riboflavin (vit. B2) and vitamin niacin are coenzymes helping in the utilization of macronutrients to provide energy, proteins & nucleic acids; vitamin K is essential in the synthesis of the enzyme thrombin responsible for forming blood-clots which seal the punctures in veins and arteries; and as antioxidants, vitamins A, C, E assist enzymes in quenching free radicals which have the potential to damage body parts such as cell membranes and nucleic acids among others.

A shortfall of micronutrients, therefore, will adversely impact vital biochemical reactions in the human body system.

Energy dense foods with deficient amounts of nutrients & micronutrients [typically highly processed foods] lead to preferential formation of adipose tissue (fatty tissue) in the human body. This was very clearly demonstrated in attempts to revitalize "severely wasted children" with energy-dense diets. The children "gained weight rapidly" but "had a deficit of functional tissue" leading to sub-normal anatomical, physiological, and immunological performance "because the balance of nutrients was not correct to allow appropriate amounts of lean tissue to be synthesized ... Obesity is only "overnutrition" in terms of energy... low intakes of essential nutrients results in many obese persons being undernourished." To elaborate this, Adipose (fatty) tissue in human body is about 80% fat and 20% water. Scientists take the storage of energy in 1 gram fat to be 9.6 kcal. It

follows therefore that 1 gram of adipose tissue stores 8 kcal of energy. Energy cannot be excreted. Experiments have shown that the process of conversion of energy to adipose tissue is so facile that it requires almost no extra energy to convert 8 kcal of energy to 1 gram of adipose tissue. But if adequate amounts of nutrients are present, then lean tissue can be fabricated with the expense of 1 kcal of energy for the process of conversion. In a nutshell, high energy and low micronutrients facilitate weight-gain and obesity. [Golden, M.H., *Proposed recommended nutrient densities for moderately malnourished children*, Food Nutr. Bull. 2009, 30, 267–342.]

Michael Pollan, American author, journalist, activist, and professor of journalism at the University of California Berkeley Graduate School of Journalism, after extensively reviewing the role of science and food industry in unintentional or intentional degradation of foods we eat, in a thought-provoking essay concludes in favour of whole foods: "And you're much better off eating whole fresh foods than processed food products." Processed foods are chock-full of macronutrients and "represent a serious threat to our health, as evidenced by soaring rates of obesity and diabetes." However, "the undersupply of micronutrients may constitute a threat just as serious", he avers. His advice is "not to eat anything your great-great-grandmother wouldn't recognize as food", which practically means to exclude all highly processed food items in the market place tody, and as far as possible to shop at the farmer's market rather than supermarkets, for there "you will find .. fresh whole foods picked at the peak of nutritional quality." [The New

York Times Magazine, January 28, 2007; http://michaelpollan.com/articles-archive/unhappy-meals/]

Whole foods are satisfying

Satiety Index: Dr. Susanna Holt and co-workers of the University of Sydney carried out a study to "produce a validated satiety index of common foods" to see what kind of foods were more satisfying and help "in the prevention of overweight and obesity." Volunteers were given a variety of foods and "satiety ratings were obtained every 15 minutes" for 2 hours after which time they could eat whatever they wanted from a "standard range of foods and drinks." A satiety index was compiled for various food items based on the responses from the study subjects. White bread was arbitrarily assigned a 'satiety' score of 100 and the 'satiety score' of "other foods were expressed as a percentage of white bread."

Satiety Index

White bread	100	Wholemeal bread	157
White pasta	119	Brown pasta	188
Croissant	47	Crackers	127
Cornflake with milk	118	Porridge with milk	209
French fries	116	Potatoes, boiled	323
Doughnuts	68	Cookies	120

Table adapted from data taken from S.H.A. Holt, J.C. Brand Miller, P. Petocz, and E. Farmakalidis, "A Satiety Index of Common Foods," *European Journal of Clinical Nutrition*, September 1995, pages 675-690.

Numbers above 100 indicate greater satiation than white bread; numbers below 100 signify lesser satiation. Perusal of a few common foods in the table above amply demonstrates that volunteers experienced lesser satiation with highly-processed foods. Consequently they were hungrier sooner compared to when they ate whole-

some foods. In particular, the difference in 'satiety' provided by **french fries (116)** and **boiled potatoes (323)** is truly striking.

It is noteworthy to see in the above table that foods with higher satiety are less processed than foods with lesser satiety. It is very likely that this may be a consequence of diminished amounts of micro-nutrients. For, lesser amount of micronutrients results in production of a diminished yields of enzymes, hormones, proteins, nucleic acids, cells & tissues, that are chemically synthesized by the body in a continuous stream. This goads the body to consume larger amount of foods so as to compensate for the deficit, as was mentioned in the chapter 'Causes of Obesity'.

Milk: Whole vs. low fat/skimmed

American derive nearly 35% of their nutritional calories from dairy and dairy products. Under the 'Causes of Obesity', a number of studies were shown to question the veracity of the recommendations of American Academy of Paediatrics & American Heart Association that "all children drink low fat or skimmed milk after the age of 2 to reduce their saturated fat intake and ward of excess weight gain."

The data keeps mounting that whole milk could be better for you than skim milk, certainly in context of obesity and diabetes. Dr. Mario Kratz, nutrition scientist at the Fred Hutchinson Cancer Research Center in Seattle after a meta-analysis of 25 studies found that 18 studies "reported lower body weights, less weight gain, or a lower risk for obesity among full-fat dairy eaters.

The other seven studies were inconclusive", reports Markham Heid in TIME [*Why Full-Fat Dairy May Be Healthier Than Low-Fat*, http://time.com/3734033/whole-milk-dairy-fat/]

It is evident from reliable results of these studies that whole milk & dairy products ought to be reinstituted in all diet recommendations forthwith to fight globesity.

Consumption of fruits

Dr. David Katz of the Yale University Prevention Research Center said: we should remember "a law we all learned from Aesop" and judge fructose "by the company it keeps," fiber and all. He gave the following order of preference for consumption of fruit:

1. Fresh fruit
2. Dried fruit
3. Sweetened dried fruit, e.g. canned fruit (a distant third in approval rating)
4. Fruit juice

For whole fruits not only contain a large gamut of micronutrients but also a cellular scaffolding made of fiber which slows down the absorption of carbohydrates and engenders a feeling of fullness, according to Dr. David Ludwig, director of New Balance Foundation Obesity Prevention Center at Boston's Children's Hospital.

IN CONCLUSION, "A healthy food should adequately contribute to micronutrient intake and have a sufficient protein and fiber content. It should also provide lipids and carbohydrates with an optimal composition. In addition, in the context of obesity prevention, a

healthy food should facilitate appetite control, i.e. promote satiety with a reduced energy intake. Thus, a healthy satiating food should have a high-nutrient density but a low-energy density", recommend Angelo Tremblay and Helene Arguin of Laval University, Canada [*Healthy Eating at School to Compensate for the Activity-Related Obesigenic Lifestyle in Children and Adolescents: The Quebec Experience,* Adv. Nutr. 2: 167S–170S, 2011; doi:10.3945/an.111.000323]. The attributes within quote marks are all hallmarks of whole foods, which should be consumed not only in schools but elsewhere as frequently as possible!

Succinctly put, the four tenets of healthy diet recommended by health gurus are: '**Eat Natural, Eat Fresh, Eat Seasonal, Eat Local**'.

Physical Activity

"Require daily physical education for students in pre-kindergarten through grade 12, allowing 150 minutes per week for elementary schools and 225 minutes per week for secondary schools."

– The Surgeon General's Vision for a Healthy and Fit Nation 2010

What do children take to be the intention of the society including schools as to the physical activity they should indulge in?

As was indicated in the chapter 'Obesity Causes', school children almost universally believe that 'physical activity' everyone is encouraging them to undertake is participating in sports. And they are not far wrong. Schools promote sports to an inordinate degree. Mass media is heavy in covering sport events from local to global variety. And yet, sports are a poor provider of health as was detailed in the chapter on 'Causes of Obesity'.

The goal of sports is fun, entertainment and skill development, not health *per se.* Exercise for health is serious business. The ideal physical activity for health ought to be undertaken with the following aspects in mind:

a. is done with health as its destined target
b. is simple, so that all can do it
c. does not require special equipment
d. can be done alone or in company
e. can be done any time of day

f. can be done anywhere
g. has the maximum potential for regularity
h. can be done through the whole life

In fact, WALKING !

What are some of the deterrents to walking?

Walking is :
a. not exotic
b. not spectacular
c. too simple so many may feel contempt for it
d. boring, especially alone
e. not promoted by celebrities
f. not promoted by schools
g. considered as an activity for older people

Why should schools promote walking?

With increasing reports of injury and risk of debilitating conditions later in life from sports injuries, I wonder if one of these days, schools, colleges, and other institutions which actively promote competitive sports in particular, will begin to be sued for injury relief and damages. In the USA, injury suits due to negligence (for instance, wet floor in buildings, faulty sports equipment, and defective playground) have been regularly filed since the past few decades. Law firms actively advertise and encourage individuals to seek legal redress for injuries ascribable to neglect of common safety precautions. Will a scenario such as the following hypothetical situation, where plaintiff is suing a school for redress of his knee problems 30 years after leaving school, become fairly common given the considerable incidence of injuries from

sports detailed in the chapter on 'Causes of Obesity' earlier in this manuscript?

Plaintiff: Pray, what is the purpose of a so called 'games period' in the curriculum of your school?

Principal: Games and sports participation is essential for good health. We would naturally like our children to be healthy.

Plaintiff: What games do the children play during the game period?

Principal: Soccer, football, cricket, volleyball, basketball, table-tennis, etc.

Plaintiff: Do the children suffer injuries in playing the games?

Principal: Yes, of course, occasionally.

Plaintiff: Which kinds of injuries are common?

Principal: Well, sprains, injured or torn ligaments, rare fractures, goose bumps, pulled muscles, etc. Generally, injuries are quite minor.

Plaintiff: Is it not true that some of the injuries can be more serious and incapacitate the patient for some time or longer? National Institute of Arthritis and Musculoskeletal and Skin Diseases (U.S. Government) in its NIH Publication No. 04-5278 warns: "Contact sports have inherent dangers that put young athletes at special risk for severe injuries. Even with rigorous training and proper safety equipment, youngsters are still at risk for severe injuries to the neck, spinal cord, and growth plates." And the United States Surgeon General's 1996 report on Physical Activities and Health citing references caution people in general, "Acute stress from sudden forceful movement can cause strains, tears, and even

fractures. For example, a vigorous swing of a baseball bat can lead to a dislocated shoulder. An attempt to accelerate forward in tennis can tear an Achilles tendon. Bending to retrieve an object can rupture an intervertebral disc. Injuries like these can result from any activity, exercise, or sport that features *sudden movements* [italics added], such as those that can occur in professional or amateur track and field, racquet sports, basketball, baseball, football, soccer, and golf. ...Basketball and soccer entail collisions with other players and frequent falls to hard surfaces. Football, hockey, and boxing, by their very nature, are sports where sanctioned and moderately controlled interpersonal violence often leads to contusions, lacerations, musculoskeletal injury, and fractures, as well as to concussions and chronic disability."

Principal: Yes, that can certainly happen, but it is rare.

Plaintiff: Perhaps severe injuries may be comparatively rare, but according to U.S. Government's Centers for Disease Control and Prevention (CDC) researchers, in USA there were 25.9 sports & recreation (SR) related injury episodes per 1,000 population in 1997, a figure greater than all transportation related injuries. And that figure was for the entire American population. Among 5-14 year olds injury episodes were 59.3 per 1,000, and for 6-17 year olds 91.2 per 1,000 during that year. Half of the injuries occurred at a school or sports facility. [J.M. Conn, J.L. Annest and J. Gilchrist, Inj. Prev. 2003: 9:117-123]

Principal: I had no idea that SR injury incidence was so high.

Plaintiff: Are you aware that acute pain or long lasting disability can occasionally generate a propensity in

the child not to engage in any sport, game or worthwhile physical activity due to the traumatic memory of pain suffered from an injury episode?

Principal: I don't really know.

Plaintiff: So you are not cognizant with many published studies that have documented that some children become reluctant to engage in sports, nay, in any physical activity due to the fear of pain from injury.

Principal: No, I am not. Can you give a reference?

Plaintiff: Oh, certainly. ["If injury, or the fear of it, are reasons for young people dropping out of sport (Sale 1995) then low risk activities which can be undertaken with little fuss, and expense may be ideal to promote for young people who are not committed to any particular recreational activity." Besides the quote, this extensive study includes copious data of injuries from a number of popular sports. (Young People's Participation in Sports and Recreational Activities, and Associated Injuries, by Dr. Karen Grimmer, http://www.ausport.gov.au/fulltext/1999/sa/youngpeoples.pdf]

Plaintiff: Coming back to the case of my client. As a student of your school, he played basketball as a school promoted activity for 4 years. Today, 30 years later, though only in his 40s, he suffers from acute pain and has been advised to undergo knee surgery. We have approached the honorable court for your school to bear the heavy expense and also to collect damages for curtailment of his productivity and suffering.

Principal: That is outrageous. How are we responsible for the damage to his knees?

Plaintiff: Do you not know that playing basketball has been documented as increasing the risk of knee trouble five-fold in later life? As we know that smoking

increases the risk of lung cancer and myriad other ailments several-fold, and tobacco companies have been fighting lawsuits for decades now, so perhaps lawsuits against sport injuries will also become common.

Principal: But why have we not heard of this?

Plaintiff: Well, you should have. The information is in the public domain [National Institutes of Health, National Institute of Arthritis and Musculoskeletal and Skin Diseases; http://www.nlm.nih.gov/medlineplus/sportsinjuries.html ; retrieved 14 sep 2006] Injuries to other body parts are periodically documented as well. For instance, "Every 13 minutes, someone in the United States goes to a hospital emergency room for a sports-related eye injury. Protect your eyes!" [National Eye Institute, http://isee.nei.nih.gov/parts/; retrieved September 22, 2012]

In any case, ignorance can not excuse the defendant from liability. The school has a fiduciary duty to its wards (students) and should keep abreast of the research and statistics of injuries and risks from any activities it promotes through its curricula.

Principal: But the plaintiff has not proved that this present knee trouble is due to basketball he played 30 years earlier.

Plaintiff: Well, there is some support for our contention from medical studies. For instance, the Arthritis website informs us: "Long after the panic and the immediate trauma treatment of a sports injury, however, there are problems lurking, problems that may not appear until much later. The most serious of these is osteoarthritis. According to one study, a single knee injury early in life can put a person at five times the risk for osteoar-

thritis in adulthood; likewise a hip injury could more than triple risk." [http://www.arthritis.org/resources/SIP/intro.asp. Retr. September 2, 2006] We believe that we are in a similar situation to the cause and effect relationship of tobacco to lung cancer, heart disease and other ailments. We have shown that my client suffered injury to his knee more than once and after each recovery, he was encouraged to play again. We contend that a five-fold risk of problems from knee injury is responsible for his dilemma today.

Principal: I can only say that schools and all society promote sports tacitly for health. We are following the norm.

Plaintiff: Do you mean to say that the sports promoted by your school are the only means of keeping healthy?

Principal: No, I don't say that. There may be other means.

Plaintiff: Can you specify any?

Principal: Yes, walking, yogasanas, calisthenics, jogging and running, etc.

Plaintiff: Are these activities also prone to similar amounts of risk as basketball?

Principal: I don't know.

Plaintiff: Well, studies show that many moderate activities such as brisk walking, rope jumping, jogging, yogasanas, etc. are much less prone to injuries, and yet perpetuate good health of the body, ostensibly even better than sports. So why do you not promote them vigorously in your school instead of injury prone contact sports if, as you claimed earlier, your objective is "We would

like our children to be healthy"?

And so on.

It is not inconceivable that such a scenario will develop sooner than later now that National Football League has reportedly settled a concussion lawsuit filed by former League players for US$ 914 million [Denise Johnson in *Insurance Journal*, April 21, 2014]. La Salle University agreed to pay US$ 7.5 million to a severely injured during a game of football [Alan Schwarz in New York Times, November 30, 2009]; and "The family of a 14 year old student athlete [Katie Patrick] settled its lawsuit against the girl's coach, her school and the gym owned by a neighboring church where she was injured during basketball practice" for US$1.5 million. [https://www.awsmithlaw.com/girl-injured-at-basketball-practice-settles-lawsuit-against-spor.html]

In the United States, "Ohio courts have held that "inherent risks" are the kind of risk you would expect out of a certain recreational activity and are not grounds for a lawsuit. For example, in football, the risk that being tackled will produce an injury is inherent to football... The law assumes that an individual participating in any particular sport is aware of the risks inherent to that sport" [https://www.ohiobar.org/forpublic/resources/lawyoucanuse/pages/lawyoucanuse-636.aspx].

Please note that in the above quote, sports are deemed to be a recreational activity, not activity for health. And it assumes that anyone (including children) participating in sports are made thoroughly cognizant of the objectives to be realized, risks associated with the activity, and alternate activities, if any, to secure the

same goals with diminished risk, in a manner similar to information they receive when the school offers enrolment in an optional course on the school curriculum.

Whether, this optional nature of sports is strictly followed by a particular school will, I think, become a contentious issue worldwide, if it becomes generally acceptable that in context of health, less injury prone activities may give similar or even better results than sports.

What can be done to address some of these objections?

Treat sports in a manner similar to the pursuit of other professional disciplines such as business, medicine, engineering, etc. School syllabi can offer sports as elective streams specifically to pursue a career as a physical education teacher, or coach, or professional player for sports leagues, and which provides a livelihood like other professions. Or they can be offered as entertainment activities in the curricula with a thorough description of the course in terms of objectives, gains, and risks, and treated like rock-climbing, rapid-river rafting, and such like.

Targeting acquisition and maintenance of health as a primary goal of the school curricula, regular WALKING in the physical education period ought to be undertaken right earnestly from an early age so that besides providing immense gains in terms of weight loss and well-being, it may becomes a lifelong habit.

How to popularize walking in schools

It is high time to conduct structured studies to highlight benefits of walking, the easiest and least injury-prone of physical activities. Schools are natural grounds

for these studies. A possible scenario for the study can be the following:

Select three sections of the same class (grade). Say 7th. Weights, heights and BMI of all children are recorded at the beginning.

1. Section A continues the usual physical activities vide school norms at present
2. Section B walks 1 1/4 miles (2 kilometers) and then engages in the usual physical activity regimen of the school
3. Section C walks 1 7/8 to 2 ½ miles (3-4 kilometers) and does flexibility exercises or yoga postures in the time remaining.

In a 3 month study schedule, BMI can be recorded after each 30 day period.

Children can increase their pace gradually until they reach approximately a pace deemed to be brisk-walking. An illustrative program may look like the following:

	Section B		Section C	
Week	Walk (kms.)	Time (min.)	Walk (kms.)	Time (min.)
1	2	25	3	38
2	2	22	3	35
3	2	20	3	30
4	2	18	4	40
5	2	17	4	36
6	2	17	4	34

For the rest of the study schedule, they can maintain the brisk-walking speed shown in the last row. After 3 months the results can be displayed prominently on

the school premises. I really believe that children will not only lose surplus fat, but will also feel better both emotionally and mentally.

Competitions in brisk walking, long-distance walking, and fast walking may also be organized to generate enthusiam and excitement among the childrenl on a pattern similar to athletic events.

But why do you say that walking is the best exercise for health?

Brisk-walking, jogging, running, are all highly recommended for sound health. R.J. Shephard of University of Toronto Faculty of Medicine in a guest editorial in a respected journal writes, "*Brisk walking* [italics added] is a popular, *low risk* [italics added] choice among the general population, and at least for the older half of our citizens, it confers many of the preventive medical dividends promised by riskier forms of physical activity. The attention of governments is now turning from the provision of costly sports facilities to encouraging the incorporation of such simple types of regular physical activity into normal daily life-the "active living" option." [*Can we afford to exercise, given current injury rates*, Injury Prevention 2003;9:99-100; retr. 14 September 2006 from ip.bmjjournals.com].

It is perhaps in response to this kind of thinking that well known health professionals including American Heart Association especially recommend walking, an exercise that can be continued lifelong without putting inordinate stress on the back, knees, and the ankles. "Walking is a low-impact, weight-bearing exercise. While it gives your heart and blood vessels a workout, it exerts only one-fifth the force of jogging on your bones and

joints. Weight-bearing exercise ... can help slow down the bone loss that occurs with normal aging and the serious bone-loss condition known as osteoporosis... You don't need special equipment ... [which] other types of exercise often [do]." [*The Healthy Heart Walking Book* by American Heart Association, Macmillan, New York 1995]

Since walking has substantial benefits with low risk of injuries, why not begin at school age to instil a habit of this salubrious physical activity? I know of people habituated to walking carry out their daily walking regimen for 30 or 45 minutes in their house or even a room during inclement weather!

Be cautious about intense exercise

One ought also to be careful about sudden or excessive stress on the heart or other organs from vigorous activities which sometimes have been fatal for many seemingly healthy people. For "Individuals with congenital aneurysms, cardiomyopathy, or cardiovascular disease [often undetected] risk fatal circulatory problems, such as an arrhythmia or heart attack, during severe exercise. Even normal individuals can develop acute physiological disorders, such as kidney failure." [*Fundamentals of Anatomy and Physiology* by Frederic H. Martini, Ph.D., Prentice Hall 1995, p 746].The United States Surgeon General's 1996 'Physical Activity and Health' report citing several references warns, "Arrythmias may be precipitated by a combination of exertion and underlying heart disease, and some can lead to sudden death."

And that is most probably what happened in New Delhi, India, where two fatalities of healthy youngsters were in prominent news over the past several years.

"19-year old dies after winning 110m [100 meter] sprint. Teen collapses on Field, Cardiac Arrest Suspected" proclaimed one headline on December 17, 2008. "[15 year old] Boy drops dead after winning [100 meter] race" announced another on December 15, 2011. [both items published in The Times of India with byline from Dwaipayan Ghosh]

But brisk-walking is safe and sound

Brisk walking is defined as a speed of 4.5 miles (7.2 kms.) per hour. This implies a kilometer in 8 minutes and 20 seconds which is actually quite manageable unless one is grossly overweight. Young people surely can walk even faster, if they want to. For sedentary individuals it is naturally prudent to begin slowly, however, with a comfortable 12 minutes per kilometer (a little over 3 miles per hour), and gradually increase distance and reduce time [Please see table on page ...]. The goal ought to be to reach 4 kms. in 33 minutes and maintain or improve those parameters to sustain good health.

It is really not necessary to spend precious time in stretching beforehand unless it has been especially recommended for some debility. Walking by itself brings enhanced circulation of blood and removes stiffness of muscles, bones and joints.

Swing your arms faster to increase speed since strides keeps pace with the arm-swing to maintain body balance. Moving arms forward and back provides exercise to a wider area of the torso compared to running or jogging in which the arms are typically folded on the chest.

Compete with yourself

We have an innate instict to progress and oft competition is used to improve performance. We can also obtain the same outcome by competing with our own self. Social Learning Theory asserts that "Research shows that the 'optimum' level of self-efficacy is a little above ability…" and who knows our own capability level better than ourself?

Measure the length of segments of your walk-routine and clock the time you take. Each week pare a few seconds off the time it took you the preceding week. You will see that when you succeed in surpassing your earlier best time, it gives you as much thrill as competing with others. Once you reach your peak, there will be days when you don't reach your best time. Your peak itself will then become the challenge and will keep you striving and one day perhaps you will even surpass your best time.

When and where

If possible walk in the morning before breakfast. Walking in the morning is generally recommended because pollution levels are at a minimum, for by and large, the world sleeps and diminished levels of activity engender less pollution. But there is another aspect, equally important and beneficial, for morning walks.

According to experts, nutrients derived and assimilated from a meal linger in circulating blood (so called blood sugar) for about four hours. This period is known as the **absorptive-phase**, and the body's need for energy during this time is fulfilled by the circulating nutrients. For the next 4 hours, that is, in the **post-absorp-**

tive-phase, the system dips into reserves of glycogen stored in the liver to satisfy body's energy requirement. Beyond 8 hours after a meal, energy demand is met primarily by the breakdown of fat (adipose) tissues stored in the hypodermis layer of the skin. "As blood glucose levels decline [after 4 hours in the post-absorptive phase] ... the adipocytes [fat cells] soon begin breaking down their lipid reserves." [*Fundamentals of Anatomy and Physiology* by Frederic H. Martini, Ph.D., Prentice Hall 1995, p 955-960]

During a typical day, an eight hour gap between meals is rare. Substantial energy needed during the morning exercise compels breakdown of the triglycerides stored in the adipose tissues thereby reducing excess fat, and maintaining the entire body in good trim. Brisk walking before breakfast, therefore, is a distinctive pathway for faster removal of body fat.

Avoid pollution

Common sense dictates that one should choose places and routes for walks with least motorized traffic. Early morning walks have this advantage too, that even thoroughfares usually have little traffic, should you have no option but to walk on main roads. As was mentioned earlier, pollution has now been implicated directly as a cause of obesity.

Walking tones up the whole body and reduces fat

Brisk walking stimulates circulation to all parts of the body. Muscles and bones are exercised; skin & hair and all internal organs are stimulated and receive richer supply of blood. Anita Bartholomew writes that walking leads to 'looking and feeling younger.' She also cites a

study from the *New England Journal of Medicine* concluding that the death rate in 60+ individuals walking merely 3 kilometres a day was half of the non-walkers. [Anita Bartholomew, *Reader's Digest* Indian edition, June 1998, p 105-08]. Nancy Bilyeau quotes *Health* magazine in asserting that walking 45 minutes a day at 6 kilometres [3 3/4 miles] per hour gets rid of excess body weight and *keeps it down*. [Nancy Bilyeau, *Reader's Digest*, Dec. 1999, p 53-8] "For as long as you can walk, the very finest exercise in the world is available to you – walking in the open air", exults Rodale. [J.E. Rodale, ed., *Encyclopedia of Common Diseases*, Emmaus, Pennsylvania: Rodale Books, Inc., 1973, p 258]

Walking work-out

If you want a real work-out while walking, try the following:

Walk for a 100 meters swinging your arms up so the fingers point to the sky and, then down and backwards as far as possible. Keep the arms stiff by not bending at the elbow. Begin with one episode and gradually increase these 100 meter stretches 5x100 meters during one kilometer of your walk regimen. You will feel the waist, abdomen, chest, back and shoulder muscles getting a vigorous stretching and contraction, virtually a massage as well as a work-out of the entire torso. These arm swings provide immeasurable

benefit to a portion of the body which is not efficiently exercised in normal routines. Benefits of this routine include:

* Firstly, it will reduce the fat layer at the waist – perhaps the most difficult place to remove fat from. A study in the prestigious medical journal, *Lancet*, quoted by Dr. Roberts reported that "among 27,000 adults in 52 countries, ... waist-to-hip ratio more accurately predicted which men and women would have heart attacks…". Dr. Roberts further noted that "Fat around the waist has been linked to a greater risk of heart disease, diabetes mellitus, stroke, hypertension, sleep apnea, disability, and some cancers, as well as higher mortality rates." [William C. Roberts, MD, Proc (Bayl Univ Med Cent). 2006 April; 19(2): 166–177].

National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) of USA Govt. likewise affirms that "If you carry fat mainly around your waist, you are more likely to develop health problems than if you carry fat mainly in your hips and thighs. This is true even if your BMI [Body Mass Index] falls within the normal range. Women with a waist measurement of more than 35 inches or men with a waist measurement of more than 40 inches may have a higher disease risk..."

"To measure your waist circumference, place a tape measure around bare abdomen just above your hip bone. Be sure that the tape is snug (but does not compress your skin) and that it is parallel to the floor. Relax, exhale, and measure your waist." [http://win.niddk.nih.gov/publications/tools.htm [retr May 25, 2010]

* Secondly, it will arrest the slump of the chest

muscles which start sagging with age. Actually, regular practice of this workout may help tone up even the existing droop of the muscles. Although female breast is not constituted of muscle, this workout should firm up the pectoral muscles to which the breast is attached. Toning up of the skin and Cooper's ligament fiber tissue of the breast also should help arrest the droop. This walking workout avoids the downward gravitational pull on breasts caused by the bounce of jogging or running.

* Thirdly, shoulder muscles, vertebral column, and abdominal muscles become strong and supple. "The parts of the body that require special attention are the muscles of the shoulders & arms, abdomen & back, legs, and the heart, lungs, and blood vessels…" counsels Canadian Air Force manual [*Physical Fitness* by Royal Canadian Air Force, Penguin Books 1981, U.K., p. 19]

* Fourthly, all body movements burn calories. Wider arch of the hand, especially upward against gravity, should help burn more calories than either brisk walking alone or even jogging & running in which arms are folded at the chest.

Thereafter, *walk* as fast as you can for a kilometer (6/10th mile). Unless it is too cold, you will most likely sweat which helps in expelling wastes & toxins from body tissues & cells and is therefore deemed to be the goal of a good work-out. The remaining 2 kms. of the regimen can be completed at the pace of brisk walking. Total time required will still be 32-34 minutes.

How to avoid unhealthy promotions by celebrities?

"If the celebrities know these products are bad for us, why are they promoting it ... Most of the time, celebrities don't care about the product they only care about getting promoted or getting money."

"Kids really look up to these celebrities, they love to watch them on television and they are significantly influenced by them. The insights these kids shed on what the celebrities themselves can do to turn this health crisis around was inspiring," says Rose Cameron, CEO/Founder of the WAT-AAH! Foundation. "Celebrities could be utilized to promote a healthier agenda, it can make a huge difference. That's what the kids are really saying in this study," she adds.

[http://www.prnewswire.com/news-releases/kids-finally-speak-on-celebrity-based-ads-for-food-and-beverages—the-celebrities-should-not-be-doing-these-commercials-they-influence-us-to-do-bad-things-234432611.html; retr. Oct. 20 2019]

The biggest influence celebrities exert on children in context of the obesity debacle is through their promotion of 'not so good' foods & beverages'. As has been emphasized earlier, mere information is not knowledge let alone conviction. But with a little effort, children can acquire discrimination and become sceptical of celebrities' promotions.

I think that a weekly period on health education from the Surgeon General's recommendation of 150-225 minutes per week for students should cover the role of celebrities in fomenting obesity. To begin with, the students in a class can be given a questionnaire to fill such as the following:

What do I eat?

What do I prefer to eat?

What should I eat?

Is there a difference between 'what I eat' and 'what should I eat'?

If there is a difference, why is it so?

Is it due to my innate preference or due to external influences?

If from external influences, whose? Ads & commercials?

Do I accept the promotion because it is attractive?

Do I accept the promotion because it is by a celebrity I like?

Does the celebrity know whether the product is good or bad?

Is the celebrity carrying out the promotion for money?

Will the celebrity promote a product even if it is bad for the health of children?

Once children have filled out the questionnaire, the class can be thrown open to discussion about varying viewpoints pertaining to the role of celebrities in promoting 'not so good' food & drinks.

In the next step, children in the class can be divided into groups of 4-5. Each group:

* chooses a celebrity who promotes foods and drinks
* gather info about the celebrity:
  - what is the net worth of the celebrity?
  - What is the annual income of the celebrity?
  - What does the celebrity earn from the promotion?

o Who, eventually, pays the celebrity for promoting the product?

o Does the celebrity and their family regularly consume the product they promote? If not, what is their diet?

* Gather info about the product the celebrity promotes

o What are the ingredients of the product?

o What is the energy density of the product?

o What is the satiety index of the product?

o How many calories does the product contain?

o How much exercise (say, walking) will be needed to burn these calories?

o Does the product lead to weight gain and obesity?

Groups of children can then incorporate this information in designing attractive placards and posters. A sort of competition could provide added zest to the project. The poster adjudged to be the best during a monthly period, could be hung in the classroom and the 2nd & 3rd ranks could be hung in the corridors of the school. Children could also be encouraged to take these placards/posters or photo copies thereof, home to be put on displayed there.

A couple examples (these are plain, not artistic) are given on the following pages.

NOTE : This project-based approach will likely accomplish several worthwhile objectives in the learning process. Children will learn to:

1. to access info from the internet
2. to utilize computer software by designing posters
3. to create posters in the drawing/painting class

Celebrities & Ill-health

Beyonce

New worth: **$350 million** Income: **$54 million** (2016)

Diet: **stickler for Healthy foods**

Endorses: **Pepsi**

Concerns: **Obesity & related diseases**

Ingredients: **Carbonated water, high fructose corn syrup, caramel color, sugar, phosphoric acid, caffeine, citric acid, and natural flavors**

Sugar **11 gram per 100 gram**

Calories **44 per 100 grams/220 per 500 g**

Physical activity required for **burning** 220 calories

At 3 mi/4.8 km per hour, walk for 54 min.
Distance covered 2.7 miles/4.35 kms.
(for a

Why does Beyonce promote Pepsi?

Does she think it is healthy?
To get money?
Is she poor?
Or, is it sheer greed?
Is she a nutritionist?
When I get sick, who do I go to? A mechanic?

Who pays Beyonce?: **As consumers, we do**

Inference?: **We pay for promotion of Pepsi at all levels**

And then?: **We buy & drink Pepsi to gain weight !!!**

REMEMBER, **Obesity increases risk of:**

Diabetes, Heart & Lung disease, multiple Cancers, diseases of gall-bladder & liver, Bone, Joint and Mental Health problems

Celebrities & Ill-health

Drew Christopher Brees

New worth: **$130 million** Income: **$22 million** (2015)

Diet: **stickler for Healthy foods**

Endorses: **Pepsi**

Concerns: **Obesity & related diseases**

Ingredients: **Carbonated water, high fructose corn syrup, caramel color, sugar, phosphoric acid, caffeine, citric acid, and natural flavors**

Sugar **11 gram per 100 gram**

Calories **44 per 100 grams/220 per 500 g**

Physical activity required for **burning** 220 calories

At 3 mi/4.8 km per hour, walk for 54 min.
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REMEMBER, **Obesity increases risk of:**

Diabetes, Heart & Lung disease, multiple Cancers, diseases of gall-bladder & liver, Bone, Joint and Mental Health problems

4. to get a focus on the principal motives: ever in sight, ever in mind, about the perfidy of celebrities in promoting 'not so good' foods & drinks and their harmful effects on human health.

And, since children will be intimately involved in the process of creating the poster from start to finish themselves, the process should engender a welcome info–knowledge–conviction sequence in their psyche leading to a positive behavioral change.

Persuade celebrities to change

Encourage students to petition celebrities about their deep concern regarding celebrities' promotions of dubious products. For example, a missive, such as:

Dear [here, fill in celebrity's name], I am an ardent fan of yours. I admire (adore, respect) you greatly. I am …. years old and study at [here, fill in name of school & its address].

"I have seen (heard) your promotion of [here, fill in the name the item]. Are you aware that the item you promote can cause [here, fill in obesity & other maladies]. I see that your reported income was [here, fill in the amount for a specific year] and your net worth is [[here, fill in the amount with the year].

Why are you promoting this product? For more money? Do you realize that we, the children or our parents, not only pay for your promotion but also for the products, and the engendered ill-health, medical costs, and the entailed suffering in the long run?

Do you realize that your celebrity status and posi-

tive intervention could nudge big business in to developing healthful products and save untold afflictions and innumerable lives? Will you not help us lead a healthy, fruitful and joyous life?

In this day and age of when mass media has become a vehicle for boosting the incidence of obesity by promotion of 'junk' foods, let mass media – email, facebook, twitter, etc. – itself become the vehicle for children to reach out and directly connect with celebrities and persuade them to become instruments of health in our society.

Given human psychology, it is not too far-fetched to hope that this can be done. Basically, people feel good if they can do something helpful and beneficial for others. But we all get caught up in the societal mores of the time, which today are amassing wealth and fame, and have to be occasionally prodded in to doing the right thing. And, hence, a widespread campaign along these may lead to a salubrious change in the attitude of celebrities in context of endorsements.

Delink sports as primary health activity due to celebrity influence

With copious information availability through the internet, children should access physical activities carried out on a regular basis by top sports celebrities. They may be surprised to discover that sports celebrities spend hours in diverse physical training for developing their health, stamina, strength, fortitude and dexterity. These are a prerequisite for their mastering skills in sports. That

is, the children should satisfy themselves that physical exercises and training are the foundation on which expertise in sports is built, and not the other way around.

Cartoon characters, healthy foods & philanthropists

Besides furnishing benefits of learning, cognitive& language development, imagination & creativity, cartoons can also be educative. In context of obesity, cartoon characters can portray healthier lifestyle such as eating nutrient-rich foods and shunning energy dense 'not so good' foods & drinks. Younger children love to watch cartoons and for many it is the first thing they do after getting up in the morning.

Regrettably, most cartoon features show cartoon characters consuming junk foods inducing a partiality for 'not so good' foods among children from a very young age. Given the myriad maladies obesity is implicated in, a strategy to show cartoon characters consuming healthy foods & drinks may help in halting the spread of obesity *a priori*. It is of course a fact that compared to highly processed foods, profit margins for healthy foods are far smaller and financing for production and airing of such cartoon features will need to be tapped from sources other than health-food industry. I wonder if philanthropists who generously donate meg-bucks for facilities and treatments of paediatric maladies can be persuaded to invest in such preventive measures to combat the curse of obesity in children as well? [https://www.insidephilanthropy.com/health-philanthropy/hospitals-and-health-centers.html]

What can we do about the plethora of chemicals inducing obesity?

First off, get truly sensitized as to how widespread the inclusion of chemicals in products of daily use really is!

> Give us this day our daily calcium propionate (spoilage retarder); sodium diacetate (mold inhibitor), monoglyceride (emulsifier), potassium bromate (maturity agent), calcium phosphate monobasic (dough conditioner), chloramine T (flour bleach), aluminium potassium sulfate (acid baking powder ingredient), sodium benzoate (preservative), butylated hydroxyanisole (antioxidant), mono-isopropyl citrate (sequestrant); plus synthetic vitamins A and D.
>
> **Forgive us, O Lord, for calling this stuff BREAD.**
>
> Averill Park J.H. Reed
>
> [Letter To the Editor of the Albany, New York, *Times Union*; quoted in *Moment in the Sun* by Robert Rienow & Leona T. Rienow, New York: The Dial Press 1967, p 167]

Observe (the box above) how chockful of chemicals a simple age old preparation like bread available in the supermarket is today.

And that has become a general trend in the marketplace. As an offbeat example:

Pears soap, one of the most successful soaps for two centuries, changed its formula from 8 ingredients (Sodium Palmitate, Natural Rosin, Glycerine, Water, Sodium Cocoate, Rosemary Extract, Thyme Extract, Pears Fragrance Essence) to 24 ingredients (Sorbitol, Aqua, Sodium Palmate/stearate, Sodium Palmkernelate, Sodium Rosinate, Propylene Glycol, Sodium Lauryl Sulfate, PEG-4, Alcohol, Glycerin, Perfume, Sodium Chloride, Sodium Meta Bisulfite, Etidronic acid, Tetra Sodium EDTA, BHT, Cl 12490, Cl

47005, Benzyl Benzoate, Benzyl Salicylate, Cinnamal, Eugenol, Limonene, Linalool) in 2009.

Chemicals are everywhere, from food & drink, packaging & containers, cookware & pots& jars, clothing, cleaning products & pesticides & herbicides, cosmetics & personal care products, furniture, TV and other gadgets, carpets and rugs, to building materials and toys; the list may seem almost endless.

Several especially hazardous chemicals (EDCs) independently responsible for weight-gain and obesity identified in the chapter 'Causes of Obesity' are given below:

Perflurooctanoic Acid (PFOA)
Tributyltin (TBT)
Atrazine
Phthalates
Bisphenol derivatives

So what does one do?

Well, one has to be careful about the use of needless plethora of chemicals in products. Manufacturers are generally required to display all ingredients in their products. We should form a spontaneous habit of reading and evaluating the unnecessary and harmful chemicals in products we use.

A general article, such as, *Explained: the toxic threat in everyday products, from toys to plastic* by Lauren Zanolli and Mark Oliver in The Guardian (https://www.theguardian.com/us-news/2019/may/22/toxic-chemicals-everyday-items-us-pesticides-bpa) can be an introductory piece, for it also furnishes recommendations as to "What can consumers do?" to mitigate or

diminish threats from chemicals.

I think that a similar strategy suggested for reducing the influence of celebrities can also be used here. For instance, in schools, children in a class can be divided into groups of 4-5 individuals. First off, they can go to prominent websites dealing with issues of harmful chemicals in the most frequently used things in the household. A few of the respected websites are:

Natural Resources Defense Council (NRDC)
http://www.nrdc.org/health/home/fchems.asp
World Wildlife Fund (WWF)
http://detox.panda.org/news_publications/glossary.cfm#vocs
Environmental Working Group (EWG)
https://www.ewg.org/consumer-guides

EWG website especially presents almost a score of guides which cover most products that are in use in the society.

Many other websites can also be tapped in this context.

After perusing general information about chemicals in myriad items and their deleterious effect on human health, children can mine data about products used in their own homes.

First, all students in a class contribute to making an exhaustive list of items bought and used in their houses. Each group then cosults their parents on most frequently used things in their houses and makes a list of the product brands. The group then searches the net about chemicals present in them, EDCs in particular, and their potential role in weight-gain and obesity. Often websites also recommend less harmful substitutes available in the

market place.

Children can be encouraged to make placards of their findings:

1. Name of product – non-sticking pan
EDC used – PFOA
Risk – weight-gain, obesity &
Better alternative – cast iron or stainless steel pan

2. Product: Plastic bags & containers
EDC used – phthalates, BPA
Risk – weight-gain, obesity &
Better alternative – jute & cloth bags, glass, ceramic, stainless steel

As the children dig in to mining information themselves, they will come across verified and suspected threats of weight-gain and obesity from myriad chemicals and the information should sink in more and more in to their subconscient memory from which a spontaneous restraint to harmful products is likely to emerge in their everyday behaviour. This can even be reinforced by hanging placards of this information in their classrooms and in their homes. Authentic and validated information may even become a conduit to changing their parents' shopping behavior.

As a starter, we can attempt to alter our diet pattern to the following sagacious tenet:

Eat organic, eat fresh

It is beyound doubt that the internet has made it possible to access information about almost anything today. And with a little time and effort we can shift to products which are in line with our health and well-being!

Q. How to minimize impact of air-pollution?

A. One can do very little about outdoor pollution in the short run.

What one can target is the indoor pollution which according to Dr. Theron Randolph, pioneer allergist, was found even more pernicious: "…indoor air pollution was 8–10 times more important as a source of chronic illness in susceptible people…"

The following are some of the more important sources. Some alternatives are also given below:

- Paint on walls leach chemicals. Lime paint is best
- Gadgets: TV, computer, furniture leach chemicals
- No smoking indoors
- Use cotton sheets & mattress
- Most Soaps & detergents have harmful chemicals
- No toys in bedroom
- Carpets can leach chemicals
- Pesticide repellants harmful. Use mosquito nets
- Animal pets increase risk of asthma
- Avoid artificial colors, flavors, preservatives in foods
- Rule of thumb: If you can smell it, you are inhaling it

National Aeronautics & Space Administration (NASA) of United States has identified several plants which draw in carbon dioxide at night and breathe out oxygen, thus furnishing a healthier oxygen-rich environment during time of sleep. Cobra or snake plant (Sansevi-

eria trifasciata) is one such plant which requires little care:

Scientific Name: Sansevieria trifasciata
Common Names: Snake Plant, Mother-in-Law's tongue, Viper's Bowstring Hemp

Place a pot or two near the bed.

Information about at-night-oxygen-provider plants is available at many websites on the internet, one being the following:

https://www.fnp.com/article/do-you-know-which-plants-release-oxygen-at-night

What can be done to minimize weight-gain effects of medications?

As was detailed in the chapter 'Causes of Obesity', medications for many illnesses have been documented as some of the leading causes for weight gain and obesity.

1. ARE THERE MEDICINES WITH LESS HARMFUL EFFECTS? : Inform yourself: Internet is a great resource to begin search for alternate medications which may mitigate the weight-gain effects. One can then discuss alternatives with one's physician and see if a change-over to less harmful treatment is feasible.

Some examples of the kind of information readily available on the net are given below:

Allergies

"If you need to take an antihistamine your best bet is loratadine (Claritin). This is because loratadine does not cross into the brain and therefore cannot stimulate the appetite center of the brain."

https://www.atlantaendocrine.com/blog/is-your-allergy-medication-making-you-gain-weight

Psychiatric disorders

Although most antipsychotics are associated with weight gain, aripiprazole (Abilify) and ziprasidone (Geodon) stand out for their lower risk. [01-Jul-2015]

https://www.scientificamerican.com/article/many-psychiatric-drugs-have-serious-effects-on-body-weight

Type 2 diabetes

Some newer diabetes medications don't cause weight gain — or will at least allow patients to lose weight.

These drugs — liraglutide (Victoza®) and empagliflozin (Jardiance®) — are also beneficial to the heart. [12-Nov-2018]

https://health.clevelandclinic.org/is-your-diabetes-drug-preventing-you-from-losing-weight

Depression

Some antidepressants may be less likely to affect weight. Effexor and Serzone generally do not cause weight gain, while Wellbutrin can cause weight loss. Sometimes switching within the same class of drugs can make a huge difference. [28-Jun-2011]

https://www.webmd.com/depression/features/antidepressants-weight-gain

High blood pressure, Heart conditions

Newer beta blockers, such as carvedilol (Coreg), don't usually cause weight gain as a side effect. [retr. 26 February 2021]

http://www.mayoclinic.org › beta-blockers › faq-20058385

Epilepsy

Antiepileptic drugs (AEDs) associated with weight loss are felbamate, topiramate, and zonisamide. AEDs associated with weight gain are gabapentin, pregabalin, valproic acid, and vigabatrin and possibly, carbamazepine. Weight neutral AEDs are lamotrigine, levetiracetam, and phenytoin. [29 November 2007]

https://doi.org/10.1111/j.1528-1167.2007.01402.x

Bipolar disorder

While any of the medications can cause weight gain, some are much less likely to do so. These include Trileptal, Lamictal, Abilify, and Latuda. [International Bipolar Foundation; by Thomas Jensen MD]

https://www.sharecare.com/health/bipolar-disorder-treatment

2. Explore alternative systems of medicine, home remedies & common sense

It is conceivable that relief and treatments exist in other systems of medicine, some of which have millenia of experience behind them, e.g. Ayurveda, the thousands of years old medical system of India; Accupressure and Accupuncture; Naturopathy; Homeopathy; just to mention a few.

Just to illustrate how some factors responsible for conditions and ways to secure relief from them, ' allergies', 'depression' and 'heart conditions' are discussed in some detail hereafter. In many cases, individuals have gained long-term reprieve from some of these conditions by adopting measures mentioned here.

Allergies

Allergies (seasonal): Seasonal allergies such as from pollen during spring and fall – running itchy stuffed nostrils, laboured breathing due to excess mucous, low energy level – respond well to a yogic cleansing routine, ***jala neti*** (cleansing nostrils with water flush).

Neti: ***Neti*** helps remove excess mucous, and keeps the nostril passage clear and moisturized. At first glance, the process may look a little bizarre, difficult and daunting, but in fact it is quite easy to learn and practise. All the same, if feasible, begin by learning initially from a Yoga practitioner.

Equipment: Special pots are available in the market-place for *neti*. It is very important that the spout should be well tapered (see picture). The purpose of a

good taper is to seal the nostril with the spout. People sometimes claim that *neti* is too difficult, though the problem may very well be an incomplete seal of the nostril due to a faulty spout which allows passage of air.

Procedure: Fill the *neti* pot with lukewarm water. Dissolve half a teaspoonful of common salt. Blow your nose to eject mucus and debris from the nostrils. Observe and determine which nostril you are breathing from at that moment. Right or left? Hold the pot in the same hand and insert the nozzle of the pot in to the same nostril from which you are breathing and make the taper snug so that no air can find passage into the nostril. Breathe through the mouth. Tilt your head to the opposite side. The water begins to flow out through the other nostril. Should the water enter your mouth, bend the head forward and downward. After half of the water has passed through, blow your nose and repeat the procedure through the other nostril until the pot is empty.

At the end, remove the remainder water by alternately blocking one nostril and blowing out of the other, four times from each side.

Finally practise a modification of *kapaalabhaati*

pranayama. Stand with body bent forward at the waist. Hold right wrist with the left palm at the back for balance. Blow out the air through the nostrils forcibly with

four motions of the head. Jerk the head up, blow out the air. Jerk the head left, blow out the air. Jerk the head to the right, blow out the air. Jerk the head down, blow out the air. This is one cycle. Do 10 to 12 cycles.

This helps remove even tiny droplets of water from the four sinuses at the base of the nostrils. Bouts of sneezing any time after the practice of *neti* signify that sinuses were not completely rid off the water. It may happen initially due to imperfect practice. If this occurs, practise modified *kapaalabhaati* again.

Note: 1. *Neti* is almost a must in these times of rising pollution.

2. It almost always provides remarkable relief in cases of seasonal allergies.

3. If *kunjal* (see above) is also practiced, then *neti* should be done after *kunjal*.

4. Begin by learning the process from a Yoga expert.

General allergies : For general allergies, a simple food supplement may provide significant relief:

Soak four almonds overnight in water. Peel off the skin and masticate thoroughly with 9-11 white pepper corns before breakfast. If you cannot stand the sharp taste of white pepper, then chew almonds before breakfast and grind and sprinkle white pepper corns on food.

Depression

"Depression is a common mental disorder. Globally, more than 264 million people of all ages suffer from depression. Depression is a leading cause of disability worldwide and is a major contributor to the overall global burden of disease. [https://www.who.int/news-room/fact-sheets/detail/depression#; 30-Jan-2020]

Medically, depression is classified into two major categories. 'Adjustment disorders' are feelings of sadness, frustration from unsatisfied desires, problems of harmony in everyday life due to circumstances, family and friends, etc. These are low level depressions of short or longer duration. 'Clinical depression' symptoms are generally taken to be weight loss, disturbed sleep and early wake-up, lack of energy, and a feeling of overall hopelessness. [*Time* magazine, July 6, 1992, p. 42]

As the word 'depress' signifies, lack of energy is a common trait in all depressions. The body feels heavy and sluggish. The mind too is lethargic. There is a lack of interest in the surroundings. The joy of living is gone. Many depressions – even the 'clinical' ones – may be a consequence of factors other than merely psychological. Check out the nutritional and physiological factors in addtion to psychological, below:

1. Shortfall of vitamins: Adequate amounts of vitamins must be available for the body to function properly. But one's diet may be deficient. This is especially true of water soluble vitamins such as 'C', as they may pass out of the body rather quickly. Try a tablet of multivitamins daily. Also take 2 tablets of vitamin C 250 milligram, one each with breakfast and dinner. In case you are sensitive to acidity, use the ester-C variant. Follow this routine for a month and note any changes. If you feel much better, this may indicate one of the important causes of your depression.

2. Insufficient Iron (Anaemia): A frequent cause of depression is deficiency of iron in the blood. Iron deficiency has become quite pervasive today. Until a few decades ago, cast iron woks, ladles, etc. were regularly used in cooking [Jethro Kloss, *Back to Eden*, Twin Lakes, WI: Lotus Press 1995, p 505-06]. Supplemental iron was thus made available to the body. With the advent of stainless steel, aluminium, and other utensils, that age-old source of iron is lost today.

A good natural source of iron is raisins. When you feel devoid of energy, lackadaisical or depressed, thoroughly chew 25 - 30 raisins. Does it help? If it does, you may have iron deficiency. Soak 20-30 raisins in a little water overnight. Chew the raisins and drink the fluid before breakfast on a regular basis.

3. Salt imbalance: In hot weather one may lose excessive amounts of salt from the body through perspiration. Athletes and sportspersons are generally aware of this phenomenon and replenish their salt-intake through fortified drinks. For a simple way to determine whether your depression and sagging energy is due to a loss of

salts or not, squeeze a whole lime or lemon in a glass of cool/cold water, and add rock salt (*saindha namak*) to taste. Stir and sip slowly. How do you feel after a little time?

4. Low blood sugar (hypoglycemia): Dr. Joseph Wilder of New York in the 1940s observed that patients suffering from low blood sugar exhibited many symptoms of dullness, anxiety and depression. [J. E. Rodale, ed., *Encyclopedia of Common Diseases*, Emmaus, Pennsylvania: Rodale Books, Inc. 1973, p 764-65]. Much of this problem is due to high consumption of simple carbohydrates (mostly refined sugar candies and beverages) which induce high speed production of insulin to metabolize the excessive sugar. All too frequently more insulin is poured into the blood than needed, and blood sugar drops below required level. Low blood sugar or hypoglycemia in turn leads to diminished energy, and depression sets in. To compensate for their lack of energy, people frequently resort to the consumption of more sugared products precipitately raising blood sugar level again and thereby creating a vicious roller-coaster.

The solution is to eat complex carbohydrates such as cereals or bread, or fruits and raw vegetables, juices and lime water, etc., rather than soft drinks and refined sugar sweets, chocolates or candies.

5. Constipation: One of the primary causes of depression could be irregular and insufficient elimination of wastes. Accumulated body wastes act as poisons and impede proper functioning of the body. To get relief from constipation:

* Eat whole grain foods such as bread, pasta, etc. Limit intake of oils and butter. Eliminate or mini-

mize processed foods in diet.
* Chew well.
* Moderate amount of liquid (warm or hot water is excellent) to be sipped with the meal.
* Avoid cold foods, and no cold liquids with meals.
* Walk 4-6 kms. a day, part in the morning, if feasible.
* Drink a glass of water just before going to sleep.
* Before leaving the bed, lie for some minutes on the abdomen.
* Drink a glass or two of normal or warm water after getting up. Walk until 'have to go'.
* Use *Indian*-style (squat) toilet
* Respond to the urge to eliminate ASAP.
* Drink a cup of warm whole milk 0.5–1 hour before bed time.

12. Homeopathic Nux Vomica x30 at need.

6. Periodic attacks of external influences: If suddenly, body starts feeling devoid of energy, and/or feels feverish, it could be due to the attack of viruses or bacteria from the environment or a temporary malfunction within the body. Try homeopathic medicine, Aconite x30: take a dose followed by another after 10 minutes and a 3rd after 10 more minutes, and one more after an hour. Thereafter, every 3 hours, if necessary, until depression and lack of energy are gone.

7. Insufficient sleep: Life is getting ever more hectic. There is never enough time to do all the things one has to do or one wants to do. To meet deadlines and cope with time pressures, people often tend to forego necessary rest and sleep. The body protests by evincing the symptoms of sluggishness, lethargy and dullness.

Mood boosters, such as caffeinated beverages or medicines may help temporarily but frequent use of these palliatives interferes even more with deep sleep. GIVE YOUR BODY THE REST IT IS ENTITLED TO.

8. Thwarted Desires: Another cause of depression could be due to frustrated expectations. We are generally told that things come to us in relation to our own effort, and if we work hard we will succeed. But our effort is merely one of several causal factors for success in any enterprise. According to the Indian scripture, *Bhagavad Gita* [chapter 18], there are five causal factors which determine the outcome of any endeavour:

अधिष्ठानं तथा कर्ता करणं च पृथग्विधम्।
विविधाश्च पृथक्चेष्टा दैवं चैवात्र पंचमम्।।१८-१४।।

Adhishthaanam tathaa kartaa karanam cha prithagvidham;
Vividhaashcha prithakcheshtaa daivam chaivaatra panchamam. 18-14

The body [inclusive of mind and vitality], the doer [ego], various instruments to accomplish work, different kinds of endeavours, and fate [the working of forces outside the human ken].

शरीरवांग्मनोभिर्यत्कर्म प्रारभते नरः।
न्याय्यं वा विपरीतं वा पंचैते तस्य हेतवः।।१८-१५।।

Shareeravaangmanobhiryat karma praarabhate narah;
Nyaayyam vaa vipareetam vaa panchaite tasya hetavah. 18-15

Whatever work anyone does with the body, speech, or mind, whether just or unjust, these five are involved in its fruition.

A not too infrequent experience in life is that similar effort exerted by two individuals of the same background gives different results; one succeeds, the other does not. The failure becomes a potent cause of frustration and

depression. We refer to the same truth when we say that somebody was at the right place at the right time. Depression is caused by shouldering the burden of excessive blame or responsibility for one's failure. If one were to truly accept factors beyond one's control, one would find solace in the realization that one did all one could and carry on with one's life. Not infrequently one realizes in life that a failure, seemingly devastating at that time, eventually turned out to be a blessing in disguise. For example, a friend seeking an academic job at a college in mid-west USA was turned down even though she was well qualified and her interview had gone well. She felt miserable. But very soon she got a better position at a West Coast college, much more congenial to her temperament. She admitted that had she been offered, she would have accepted the first job and would have missed out on a rare opportunity.

An awareness of these five factors ought to be so cultivated, therefore, that it becomes an integral part of one's mindset. Then one can still make all the effort possible to accomplish an objective but will not go into depression if it does not succeed, realizing that factors and forces other than one's own enterprise do play an important role in the outcome.

Abraham Lincoln was surely referring to this truism when he wrote, "I claim not to have controlled events, but confess plainly that events have controlled me." [Abraham Lincoln, *Letter to A.G. Hodges*, April 4, 1864]

"To do at each moment the best we can and leave the result to the Divine's decision, is the surest way to peace, happiness, strength, progress and perfection."

– *The Mother* [Sri Aurobindo Ashram, Pondicherry]

High Blood Pressure, Heart conditiions :

The uninterrupted flow of blood in the cardiovascular system delivers life-sustaining oxygen and the nutrients to the entire body tissues and removes wastes for eventual elimination. The unceasing pumping action of the heart in combination with an extensive network of vessels accomplishes this circulation of blood. Of all the body organs, therefore, the importance of heart is difficult to overstate.

"The global cardiovascular drugs market stood at USD 47.29 billion in 2018..." and according to World Health Organization (WHO) 17.9 million people died from CVDs in 2016, representing 31% of all global deaths.

What can be done to minimize medication for CVDs?

Heart :

*** Stronger the heart, greater the pumping action:**

The heart of a non-exercising but otherwise healthy adult weighs approximately 300 grams and beats about 80 times per minute. At 60 millilitre (mL) per beat, about 5 litres of blood are circulated through the system per minute.

With regular training the heart muscle can gain as much as 70%, that is the heart may now weigh 500 grams. This stronger heart is now capable of pumping something like 80+ mL per stroke. Since at rest, the same amount of blood, about 5 litres per minute, is circulated in the body, the heart needs to beat only some 60 times to meet this target.

It is, of course, obvious that the training required for strengthening the heart muscle has to be aerobic. Please look up the section 'Physical activity' earlier in this chapter and adopt the final sub-section 'Walking work-out' in your daily routine. This continuous work-out of the cardiovascular system for 30+ minutes should do wonders for both the obesity problem and the cardiovascular system.

*** Slower heartbeat gives rest to heart muscle :**

Since the heart has to function nonstop from birth to death, lowering the number of beats per minute results in more rest for the heart muscle. Surplus time between the beats also results in more blood to pour from atria in to the ventricles. This results in a higher supply of blood per beat, for, the FRANK-STARLING PRINCIPLE postulates that if more blood is available in the ventricles, more will be pumped out: that is "more in= more out" is the general rule [Frederic H. Martini, *Fundamentals of Anatomy and Physiology*, 3rd ed., Englewood Cliffs, New Jersey: Prentice Hall 1995, p 707]

*** Greater networking of blood vessels to heart**

A great deal of cardiovascular disease is due to an impediment to the supply of blood to the heart muscle itself – a condition termed as coronary heart disease (CHD). Aerobic exercises can increase the demand for oxygen by the heart muscle several fold. To fulfil this high demand, coronary artery fashions a more extensive and wider network of arteries and capillaries. This extended network can provide an alternate route to supply blood to the heart in case of any blockage.

Blood vessels :

Endothelium (membrane lining the blood vessel walls) damage and dysfunction has now been accepted as one of the most important markers of atherosclerosis (cardiovascular disease due to hardening of arteries).

"In 1954 it was shown that 500mg of vitamin C three times a day made great improvements in the arterial blockages of patients with heart trouble. Vitamin C is also seen as an anti-oxidant"; https://www.warnerorthopedics.com/vitamin-c_orthopedics/; 15-Aug-2014]

Besides supplementing the diet with vitamin C, yoga postures and meditation have been documented as significantly beneficial for endothelium dysfunction. Thus a 6-week workshop conducted by Satish Sivasankaran MD of Yale Unibersity School of Medicine "improved blood vessel function by 17%. Blood vessel function, also called endothelial function, is the way vessels contract and expand to aid blood flow and is a measure of healthy vessel function. However, study participants who had heart disease had close to a 70% improvement in endothelial function" reports Pdggy Peck [https://www.webmd.com/heart-disease/news/20041108/yoga-gets-hearts-healthy; Nov. 8, 2004]

Reversal of decay of cardiovasculary system :

One of the first indications of the disease of heart mucle itself is an inability to pump adequate amounts of blood to the tissues and organs. The cause is a weak squeezing stroke of the left ventricle. Whereas deaths from heart attack and stroke are declining in USA, the incidence of congestive heart failure (CHF), as the weaker ventricle stroke is called, and fatalaties from CHF

are increasing. The symptom which generally leads to its detection is dispnea (shortness of breath) during exercise, escalating to dispnea at rest. CHF may develop due to diseases of coronary artery and heart valve, or weakening of heart muscle, or hypertension. Severity of CHF may determine the need for heart transplant. CHF patients in earlier times were advised rest. Since the 1990s, a number of clinical studies have revealed the benefits of controlled exercise so much that *The Committee on Exercise, Rehabilitation, and Prevention of the American Heart Association Council on Clinical Cardiology* were led to advise the insurers and other third-party payers of medical costs to promote exercise training programs for CHF patients (*Circulation* 2003; 107:1210).

A major cause of CHF has been found to be respiratory dysfunction due to weakening of respiratory muscles (F. Joachim Meyer, MD, *Circulation*. 2001;103:2153). Many clinical studies with CHF patients have been carried out in which inspirational muscle training (IMT) succeeded in improving functional performance and lessening dsypnea (Laoutaris I, et al, *Eur J Cardiovasc Prev Rehabil.* 2004 Dec;11(6):489-96; Jerome L. Fleg, MD, FACC, FAHA, *J Am Coll Cardiol*, 2008; 51:1672-1674). Deliberately slowing down respiratory rate to some 6 breaths from a normal average of 12-15 breaths per minute as a regimen for some weeks was also reported to alleviate shortness of breath, improved gas exchange in the lungs and increased exercise performance (Luciano Bernardi, MD, et al, *The Lancet*, 351 (9112) 1308 - 1311, 2 May 1998).

Implications of CHF research: A few salient points

emerge from the above studies: that, even after chronic heart disease has manifested, practice of a judicious regimen of exercise may not only halt the progress of disease but might even reverse the decay and, much can be accomplished to alleviate the condition by enhancing respiratory efficiency. An efficient respiratory system should decrease the number of breaths per minute. The heart rate too decreases as higher oxygen saturation is achieved with enhanced time for gas exchange. Both of these will entail a significant saving of energy and stress. And if higher amounts of oxygen can be made available without placing increased stress on the body, the system may respond by repairing the damaged tissues.

Yogic breathing and breathing exercises (as the Indian practices, *pranayama* are generally understood) selectively deal with clearing air passageways, respiratory muscle training, and eventually enhancing oxygen intake at rest. As detailed in the pdf file 'Self-care for Improving Lung Function & Breathing' with a gradual progression in time and frequency, it is entirely feasible that milder forms of CHF may altogether disappear and more severe forms of CHF may become manageable.

Conclusion: Quantity and dependence of medications (causing obesity) for CVD can be reduced by:

Judicious exercise regimen, supplemental vitamin C, yoga postures, yogic breathing, yogic breathing exercises.

Alternate medical therapy for treatment

Side-effects of weight-gain from medications may

perhaps be curtailed by exploring other systems of medicine such as Homeopathy. I think a Homeopathy professional should generally be consulted for chronic diseases as a matter of course. It is possible that non-obesity causing treatments can be found for the conditions in which allopathic medicines have led to substantial weight-gain.

Minimize use of dairy & dairy products with antibiotics

It will be prudent to research about the kind of milk and milk products one consumes. Since dairy and dairy products form a big segment of diet for most people, with the help of the internet, one should find out if they contain unnecessary antibiotics.

From what has been detailed in this treatise, it is of course better if one can consume 'organic' products.

Thyroid disorder correction

Lack of adequate amounts of thyroid hormone, thyroxin, results in diminished metabolic activity and may be a cause of weight-gain.

People with ebbed energy levels and frequent or persistent bouts of fatigue and otherwise unexplainable propensity to weight gain should therefore be well advised to seek medical check up and expert guidance. Hypo-thyroid disorder is quite common and suitable medication is easily available for its correction.

Aspiration

विश्वं पुष्टं ग्रामे अस्मिन्ननातुरम्।।

– *Yajurveda* 16:48

In this village [global village],
may all sentient beings be robust and healthy