

Excess of High Caffeinated Energy Drinks Linked to Dangerous Heart Rhythm Disorders which can cause Sudden death.

This is a story of a young ambitious medical student who after a stressful and overburdened day started taking energy drinks in evening after duty. It gave instant high, helped him to be awake. He took two or three of these that evening. He immediately noticed being uncomfortable and awareness of racing heart. Being a medical student, he immediately did an electrocardiogram (ECG) which is a test that depicts electrical activity of heart on a piece of paper and it shows abnormal heart beats. He was put on continuous heart rhythm monitoring which revealed runs of ventricular tachycardia.



Figure 1: Runs of ventricular tachycardia in Holter recording of the patient (abnormal heart rhythm originating from lower chambers of heart).

Ventricular tachycardia is an abnormal fast heart rhythm originating from lower chamber of heart and is known to be associated with sudden cardiac death. He was immediately started on medicines to suppress these abnormal heart rhythms and fortunately responded to it. Other tests like echocardiogram, cardiac MRI were normal ruling out any other structural cause of these rhythm abnormalities.

In this article we will like to educate readers about Energy drinks & dangers of legalized or unregulated addictive substances? European countries like Norway, Denmark have banned these energy drinks but they are able to make their way to India & other countries.

What are these high caffeinated energy drinks?

A beverage that typically contains large amount of caffeine, added sugars, other additives & legal stimulants such as guarana, taurine & L-carnitine. These legal stimulants can increase alertness, attention, energy as well as increase in blood pressure, heart rate & breathing.

They have billion-dollar market globally. Energy drinks are frequently marketed towards active young adults & adolescent populations, which also represent the majority of consumer base (aged 20-39 years). **But are they a healthy choice? – Definitely NO as we describe risk with these drinks.**

What is caffeine?

Caffeine is a stimulant present in coffee, tea, energy drinks. ***The FDA considers up to 400 mg of caffeine per day as an acceptable amount for healthy adults.*** *Caffeine with sugar has great addictive potential comparable to banned drugs like opioids.*

What is the risk?

Energy drinks are designed to give an “energy boost” to the drinker by a combination of stimulants and energy boosters.

The major constituent in most energy drinks is caffeine. They usually contain 80-150 mg of caffeine per 8 ounces, which is equivalent to 5 ounces of coffee or two 12 ounces can of caffeinated soda. Most of the brands on the market contain large amount of glucose while some brands offer artificially sweetened versions, other commonly used constituents are taurine, methylxanthines, vitamin B, ginseng, guarana, yerba mate, acai, maltodextrin.

The problem with energy drink consumption is that these beverages often contain high amount of labelled & even masked caffeine, as well other substances such as guarana, ginseng & taurine in variable quantities which may generate uncertain interactions.

Guarana is a Brazilian plant containing “guaranine” which is nothing more than caffeine, in about twice the concentration of caffeine found in coffee beans (about 2-4 % caffeine in guarana seeds compared with 1-2 % in coffee beans).

Ginseng exerts its stimulating effects through a mixture of ginsenosides, polysaccharide peptides, polyethylenic alcohols and fatty acids.

The major active component of ginseng are ginsenosides which act on several different tissue & cells & produce a kaleidoscope of biological effects. Taurine is an amino acid that exerts a number of physiological functions, including cell volume regulation & inhibitory neuromodulation.

When considering body size previous research recommends keeping caffeine intake within 3-6 mg/Kg as this is the level of intake that is ergogenic & found to be well tolerated regardless of size & age. Given this, it is important to also consider the total amount of caffeine from all sources of beverages and food (e.g., coffee, tea, chocolate, etc.) within an individual tolerance limit, to make sure excessive amount are not consumed.

Possible drug interaction between Panax ginseng & warfarin phenelzine & alcohol have also been reported (NOT FOR THOSE ON BLOOD THINNING AGENTS -WARFARIN).

Caffeine undergoes placental transfer which is the reason for limiting dietary intake during pregnancy (UNSAFE IN PREGNANCY).

How much caffeine in different brands of these energy drinks?

Energy drinks are prepacked & ready to drink functional beverages while energy shots are a similar more concentrated ready to drink beverage sold in 2-5 fl oz volumes.

The caffeine content of different energy drinks is as under:

- 12 oz Red Bull: 111 mg
- 16 oz Rockstar: 165 mg
- 16 oz Monster: 172 mg (1 can is considered 2 serving, each serving listed as 86 mg)
- Monster 24 fluid ounce (682 ml) – 240 mg caffeine
- 2 oz 5-hour energy shot – 215 mg
- 2 oz 5-hour extra strength – 245 mg
- 8.4 oz cocaine energy drink – 280 mg
- Sting energy drink – 200 mg caffeine
- Monster Ultra Blue & Ultra Red - 140 mg/can,
- Monster Ultra Black's - 155 mg/can
- Monster ultra-watermelon, ultra-gold and ultra-peachy can - 150 mg/can
- Monster vibrant ultraviolet weighing - 140 mg/can.
- 8 oz brewed black coffee: 65 to 195 mg depending on the strength of brew.
- Red Bull 8.4 oz packs 80 mg of caffeine.
- Monster Energy 16-ounce vessel- impressive 160 mg of caffeine.

Monster towers over coke with a whopping 160 mg of caffeine per can, equivalent to 2-3 invigorating cups of coffee. Coke lags behind with a mere 35 mg. But there's more – Monster 16 ounce can pack 27 gm of sugar a sugar rush with 7 teaspoons and to top it off a dash of artificial sweetener sucralose for an extra kick.

In addition to caffeine these drinks also contain other substances like sugars, artificial sweeteners, Guarana (which is derived from South American plants which also contain caffeine).

High Caffeinated Energy Drinks – Don't Let the Monstrous Drinks Sting Your Health



Figure 2: Various High Caffeinated Energy Drinks available in Indian Market

LOOK OUT WHEN YOU ARE CROSSING SAFE LIMIT & ENETRING POTENTIALLY DEATH ZONE

Few Monster / Red Bull /Sting drinks, Few Monster and few coffees, Few Monster/ Red Bull plus your Gym supplement, Energy drinks plus alcohol, Energy drinks in children who have less body weight and a single drink may be lethal.

Patients with heart rhythm disorders like Paroxysmal Supraventricular tachycardia, atrial fibrillation, ventricular arrhythmia, weak heart, cardiac genetic diseases called channelopathies with high risk of lethal arrhythmias, taking cardiac medications which have potential to interact to constituents of energy drinks

WARNING & CAUTIONS

WARNING LABELS: “**Not recommended for children, pregnant or nursing women & person sensitive to caffeine**”

MONSTER goes a little farther recommending its consumers consume responsibly – **limits 3 bottles per day.**

Others give guidelines on how drinking a half can a day for a while to gauge effects before increasing consumption. These warnings are on the back & not highlighted.

FDA currently limits 400 mg of caffeine as a safe level for healthy adults, they discourage caffeine consumption in children & adolescents & no safe level has been determined.

Children are small & a single drink may be enough to raise blood pressure & heart rate to dangerous levels & cause serious arrhythmias (heart rhythm problems) and sudden death.

The reason may be excessive catecholamine release after the consumption of energy drinks.

	Sting Energy Drink	Recommended
Caffeine	200 mg	400 mg
Sugar	34.3 gm	25 gm (women) & 36 gm (men)

BUT IS THIS MUCH WARNING ENOUGH TO LET THESE DRINKS BE FREELY PROVIDED BY ILL EDUCATED VENDORS & CASUAL CONSUMERS?

WHAT IS CAFFEINE SENSITIVITY & SYMPTOMS & A SINGLE DRINK CAN BE DEADLY?

A single can or drink can create problems if you have caffeine sensitivity.

If you have headache, jitters, insomnia, restlessness, anxiousness, racing heartbeat with caffeine drinks you should be cautious that you are caffeine sensitive.

Genetics: There is a genetic component how your body process caffeine, meaning that your genetic makeup can make you hypersensitive to caffeine. Variation in ADORA2A gene which correlates with variation in caffeine's effect on sleep from one person to another.

Infrequent users have higher sensitivity. If you have baseline anxiety, stress, caffeine can worsen the symptoms you are already experiencing, for example, caffeine can promote panic attacks, loss of sleep & worsen anxiety symptoms in those with anxiety disorders.

Vulnerability to caffeine affected by tolerance and genetic factors

Vulnerability to caffeine intoxication after bolus caffeine doses, such as those delivered in energy drinks, is markedly affected by pharmacological tolerance. Tolerance refers to a decrease in responsiveness to a drug as a result of drug exposure. Daily administration of very high doses of caffeine (e.g. 750–1200 mg/day) can produce complete or partial tolerance to caffeine's subjective, pressor, and neuroendocrine effects and these youth may be more psychologically prone to other addictions to get a high/ kick.

Do these energy drinks aid performance?

Research indicates that moderate consumption of these beverages can significantly improve the abilities of elite athletes across a range of sports, from endurance to high intensity events.

The effect of caffeine in Monster energy drink. Caffeine savored in moderation it works wonders, excessive indulgence could unleash a range of adversaries such as insomnia anxiety, racing heart beats & more.

Many of these Monstrous energy drinks delivers a surge of 160 mg caffeine in a single 16 fl oz can immersing you in an intense rush of energy in every sip.

Are Energy Drinks healthy or not?

Unleashing the Monster or the Red Bull or sting or any other energy drink might excite your taste buds but watch out. The 8.4-ounce energy punch holds a whopping 28 gm of sugar, enough to exceed recommended daily limits for added sugar, leaving your health to face the aftermath. There are additional problems in addition to Caffeine toxicity/overdose as discussed before

Caffeine dependence

Substance dependence is defined using a generic set of cognitive, physiological, and behavioural symptoms, including the inability to quit, use despite harm, using more than intended, withdrawal, and tolerance.

Caffeine withdrawal

The symptoms of caffeine withdrawal, the most common of which is headache, begin 12–24 h after the last dose of caffeine

Combined use of caffeine and alcohol may be problematic

There is an association between the heavy use of caffeine and the heavy use of alcohol

Relationship of caffeine to dependence on other substances

Studies in adult twins show that lifetime caffeine intake, caffeine toxicity and caffeine dependence are significantly and positively associated with various psychiatric disorders including major depression, generalized anxiety disorder, panic disorder, antisocial personality disorder, alcohol dependence, and cannabis and cocaine abuse/dependence

The window period of dangerous heart rhythm disorders like ventricular fibrillation & successful detection & treatment is extremely short. None of patient survive if treatment is delayed beyond ten minutes and because of lack of public awareness and medical & genetic autopsy of these cases most of the evidence to cause of sudden cardiac death in India is missed. There are more instances noted as described below but cannot be confirmed because of lack of autopsy or prompt medical care and so a caution is to be advised to those who mix these drinks with exercise.

CASE 2

This is a story of a child who took an energy drink fancied by the colors of it and thinking it as a simple sugary drink like other soft drinks, even the illiterate cold drink seller didn't bother to know what is written about the composition and warnings on the back of these drinks in English which most of Indian people may not understand. The child felt restless after the drink and died suddenly – **A SUDDEN CARDIAC DEATH.**

CASE 3:

This is a story of a young body building enthusiastic person. He started working on his body but in order to push his exercise performance and get quick results got attracted to health supplements. He used to take pre work out packs and energy drinks and had a cardiac arrest on treadmill – **A SUDDEN CARDIAC DEATH**. We are witnessing a sudden rise in sudden death reported with exercise and also most of the people joining fitness programs are not screened by a cardiologist for latent heart disorders and most of fitness coaches have no training or education of handling emergencies like sudden blackout or cardiac arrest during an exercise session and most of the gymnasiums are not equipped with an automated external defibrillator.

DO NOT MIX CAFFEINE WITH EXERCISE AND DEFINITELY NOT HIGH CAFFEINATED ENERGY DRINKS WITH PRE-WORK OUT SUPPLEMENTS: You will easily cross the safe zone.

Big Muscle Nutrition Freak Pre work out pack: 1 scoop 188 mg caffeine and 2 scoop: 376 mg

Vaso Rage Pre workout: 6 gm contain 276 mg caffeine

Fast & Up Prework out supplement: 300 mg caffeine in 10gm

Pre work out Energy Formula: 14 gm contain 100 mg caffeine

For the understanding of common public, we will define what is sudden cardiac arrest and why it is so difficult for Indian population to survive a cardiac arrest.

WHAT IS SUDDEN CARDIAC ARREST ?

It is defined as non-traumatic, unexpected fatal event occurring within 1 hour of the onset of symptoms in an apparently healthy subject.

The heart's electrical activity becomes disordered. When this happens, the heart's lower (pumping) chambers contract in a rapid, unsynchronized way- "fibrillate" rather than beat. The heart pumps little or no blood. Collapse and sudden cardiac arrest follows.

SCA is fatal if not treated immediately by prompt and appropriate emergency care which involves administration of cardiopulmonary resuscitation (CPR), shock treatment to the chest to reset the heart's rhythm (defibrillation) and advanced life support.

WHY THIS HAPPENS

This occurs due to sudden appearance of three possible rhythms in heart

1-Ventricular fibrillation

2-Ventricular tachycardia

3-Asystole

WHAT IS VENTRICULAR FIBRILLATION ?

Ventricular Fibrillation (VF), the abnormal heart rhythm that most often leads to sudden cardiac arrest, is treatable. If the heart can be shocked quickly with a defibrillator, a normal heart rhythm may be restored. An automated external defibrillator (AED) is a portable device used to administer an electric shock to the heart and restore the heart's normal rhythm during sudden cardiac arrest.

WHAT IS THE WINDOW PERIOD FOR REVIVAL ? - LOST TIME IS NEVER FOUND AGAIN

Sudden cardiac arrest is reversible but the window period to revive is extremely short. Reviving a victim with sudden cardiac arrest is like snatching life from jaws of death. After a cardiac arrest there are four to six minutes before brain death occur. Chances of survival reduce by 7-10 % with every passing minute.

It is essential that defibrillation be administered immediately following the cardiac arrest. If the heart does not return to a regular rhythm within 5-7 minutes, this fibrillation could be fatal. If defibrillated within the first minute of collapse, the victim's chances for survival are close to 90 percent. For every minute that defibrillation is delayed, survival decreases by 7 percent to 10 percent. If it is delayed by more than 10 minutes, the chance of survival in adults is less than 5 percent.

In India because of lack of awareness and immediate and adequate medical intervention at present more than 90% of Indians who experience sustained ventricular fibrillation face certain death.

LOST TIME IS NEVER FOUND AGAIN : EVERY MINUTE COUNTS

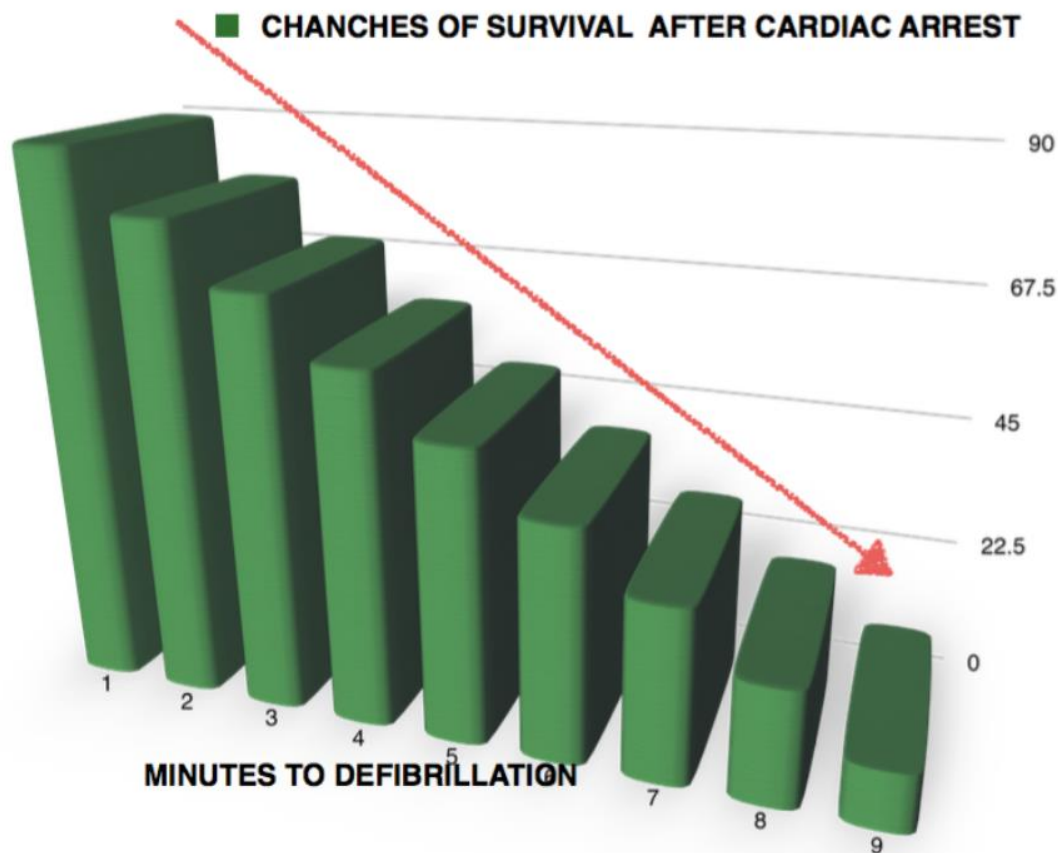


Figure 2 : Chances of survival decrease every minute by 10 % CPR & AED therapy is delayed and after 10 minutes nearly no one survives. LEARN CPR SAVE LIFE

WHAT IS VENTRICULAR TACHYCARDIA?

Is a type of fast heartbeat that arises from abnormal electrical activity in the lower chambers or ventricles of the heart. This rhythm is more organized as compared to ventricular fibrillation but may turn into ventricular fibrillation or itself lead to hemodynamic instability and cardiac arrest. It is found initially in about 7 % of people with cardiac arrest.

In diseased-scarred hearts and weak hearts with poor pumping capacity, patients with coronary artery disease or certain electrical problems of heart are associated with increased risk of ventricular tachycardia.

This is an emergency and immediate electric shock is needed in most of cases.

WHAT IS ASYSTOLE?

Asystole is a state of no electrical activity from the heart and therefore no blood is pumped. On ECG you will see a flat line. It is found in about 28 % of people in cardiac arrest. Out of hospital survival rates are poorest in asystole and less than 2 %.

TO SUM UP FOR SUDDEN CARDIAC ARREST: ACT JUST NOW OR ELSE IT WOULD BE TOO LATE

Immediately advanced cardiopulmonary resuscitation and defibrillation will be required for SCA victims. Delay means death. Survival rates in advanced economies with trained general public and access to automated defibrillators is around 7 % .In India because of lack of presently situation is very gloomy. After recovery your electrophysiologist will investigate to find out the cause.

What is Automated External Defibrillator ?

Automated External Defibrillators (AEDs) are devices that are used to deliver the shocks to correct ventricular fibrillation. During ventricular fibrillation there is no effective pumping function of heart leading to lack of blood supply and oxygen to brain, heart itself and other organs. This device can save lives if made available within 4 to 7 minutes of the onset of ventricular fibrillation as untreated ventricular fibrillation leads to death within minutes.



Figure 3 : Automatic External Defibrillator

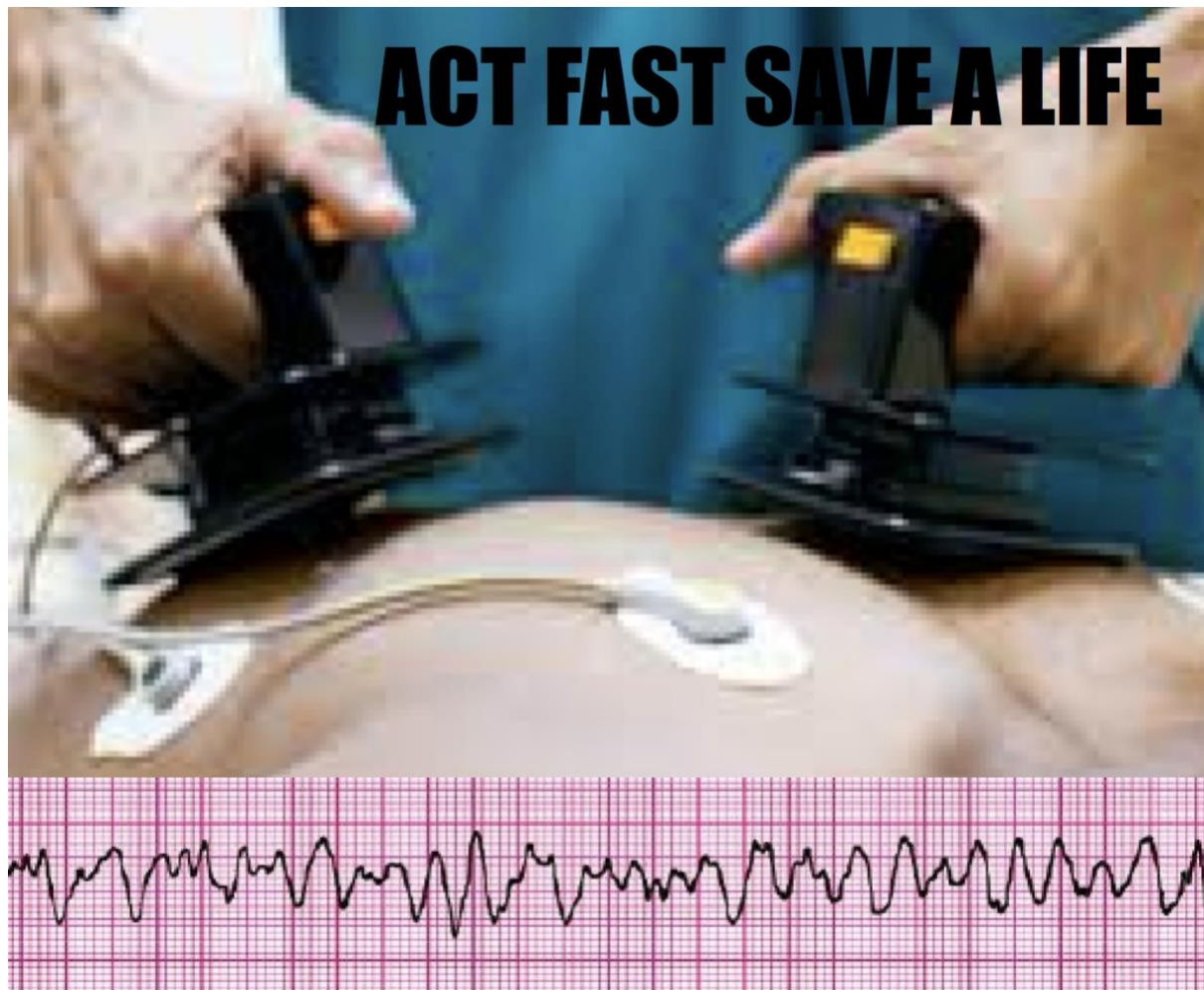


Figure 4 : Automated external defibrillator use to convert ventricular fibrillation to normal rhythm

HOW IT WORKS

An AED consists of a small computer (microprocessor), electrical circuitry, and adhesive electrode pads. The electrodes collect information about the heart's rhythm and the microprocessor interprets the rhythm. If the heart is in ventricular fibrillation, the microprocessor recommends a defibrillating shock. The shock is delivered by way of the electrode pads, through the victim's chest wall, and into the heart. The shock stuns the heart momentarily, stopping all activity. This gives the heart a chance to restart normal electrical activity and resume beating effectively.

NOT MUCH TRAINING REQUIRED

These machines have voice prompts to easily assist a novice at successfully using the device. It is important for bystanders who witness the collapse of an SCA victim to act quickly.

AED IS EXTREMELY SAFE

If a person does not need the shock of an AED, the machine will not deliver a shock. It is not possible to hurt someone with an AED; they can only be used to save someone's life.

THINGS TO CONSIDER BEFORE WHEN YOU JOIN A FITNESS PROGRAM

1. Get yourself screened by a cardiologist by way of non-invasive test like electrocardiogram (recording of heart electrical activity on paper) and physical examination. If cardiologist suspect a heart disease he may do an echocardiogram (non-invasive ultrasound of heart) or a treadmill test (exercise stress test with ECG and blood pressure and heart rate monitoring) before you join a strenuous exercise program
2. Family history of sudden death in a relative : Screening is must
3. Do your fitness coach has a training in cardiopulmonary resuscitation (CPR) & use of automated external defibrillator (AED).
4. Does your Gymnastic or fitness centre is equipped with automated external defibrillator

What medical academies recommend?

American academy of Pediatrics states that caffeine & other stimulating substances contained in the energy drinks have no place in the diet of children & adolescents.

The American federation of State High School Association recommends that young athletes should not use energy drinks for hydration & information about potential risk should be widely distributed to young athletes.

What can you do?

Teachers & other school staff can educate students about the danger of consuming too much caffeine, including energy drinks.

Coaches can educate athletes about the difference between energy drinks & sports drinks & potential dangers of consuming highly caffeinated beverages.

BUT WHY YOUNG ARE GETTING IN TRAP OF THESE LEGALISED ADDICTIONS?

The aim to achieve higher level of athletic performance & academic success leads to a gradual increase in consumption in the young population. Although the mood of an individual in the social environment becomes better in a short time after consumption of

these substrates, the claim about increasing academic performance & athletic performance is not true.

Another important subject that has received too little attention is that unscientific promotions by beverage firms, attractive shows in public fields, more advertisements in readable and visible media & extraordinary sports activities as stimulants for using the energy drinks stimulate consumption by serving as false models.

The main concern is that these beverages could easily lead to severe cardiovascular events in young & other individuals who have underlying silent cardiovascular disease. Because of their high amounts of caffeine & other substances, dangerous arrhythmias can easily develop in hearts of individuals who consume them. The problem is that there are many additional sources of caffeine that are masked by labelling.

Frequent ingredients like guarana, ginseng, taurine have caffeine concentration in different energy beverages that are higher than those found in coffee. Which dose of any of these substances with or without other artificial supplements or / and alcohol might be mostly dangerous is one of the most important points that remain unknown.

In case it seems clear that energy drinks, some beverages & some supplements that include stimulants might lead to critical & rarely irreversible cardiovascular events in the young population. Judged by these criteria, this should be discussed to a greater extent in scientific meetings, government related offices of health ministry & public environments for controlling the intake of these products in young population.

GET ENERGIZED THE NATURAL WAY

Other proven strategies to help boost your energy naturally: Food & beverages aren't the only source of improved energy levels. There are a host of lifestyle habits you can adopt that may help with energy and of course are caffeine free.

GET MOVING: While it may seem counter intuitive to expand energy to gain more, the truth is that even a small amount of low or moderate aerobic exercise has been shown to do just that. *American council on exercise: while the recommended amount of exercise for adults is at least 150 minute of moderate intensity or 75 minute of vigorous intense activity per week. American council of exercise notes you may see improvements in sleep with as little as 20 minute of exercise three times a week. **Exercise releases endorphins which is more powerful than any addiction substances to give you a high.***

Get Enough Sleep: *Seven to nine hours of sleep each night. **Sleep releases melatonin which again is something which will give you a high and calm no addictive substance can match.***

Practice Yoga & Mindful Meditation: Slowing down & breathing deep won't only make you feel calmer – this approach can also increase energy, improve mood, focus & energy levels.

Cut Back On-Screen Time: Living with your phone in your hand can drain your energy. Use of light emitting screens before bed (think cell phones, tablets, e-readers & television) increase the time it took to fall asleep, decrease the quality of sleep & decreased the feeling of alertness the following morning. They alter your circadian rhythm if you are exposed to artificial light in night.

Get some sunshine: Vit D is known as the “sunshine vitamin” for a reason. When the sun’s rays hit our screen, it tells our body to make more vitamin D and this process can do wonders for our energy & mood. Vitamin D deficiency can be linked to muscle fatigue. In addition, vitamin D levels in the body can have a direct effect on depression & other mood disorders. National institute of health recommends standing in the Sun for 5 to 30 minutes a couple of days per week.

Healthy Breakfast: Breakfast is the most important meal of the day. A protein rich breakfast that also contains whole grains is a perfect balance of energy boosting nutrition.

Drinking More Water: Mild dehydration of just 1.5% of the body’s normal fluid amount can significantly affect energy, mood & brain power because it decreases the volume of blood in the body & therefore the amount of blood reaching the brain. ***Plain Unflavored water is the best beverage.***

Conclusions and implications

The absence of regulatory oversight has resulted in aggressive marketing of energy drinks but this can have dangerous health related side effects , addiction potential and definitely not for children , adolescents , pregnant , should never be mixed with exercise , alcohol and also not recommended for patients having heart rhythm problems , poor cardiac reserve , patients on cardiac medications.

I request ICMR/ Central and State Health Department to establish norms for safe limits of these legally allowed addictive substances being freely sold in market. Ban then at schools , Gyms and to be sold casually. State and central health department should intervene and all sudden deaths in Gym or after consumption of these drinks should be audited. Allowing free trade of poisons Monstrous energy drinks to Sting health of nation should not be permitted.

ARRHYTHMIA SUPPORT NETWORK : Pulse is Life



A-Fib, Sudden Cardiac Arrest Support Network: Act Fast Keep Beating

The noblest question in the world is what good may I do in it. *Benjamin Franklin*

Education is greatest weapon for change : This message has been issued in public interest by arrhythmia support network (<https://arrhythmiasupport.com>). Dr Rohit Walia is senior consultant cardiologist available exclusively at Christian Medical College Hospital , Ludhiana, Punjab and is available in person to poorest of poor patients or teleconsultation to remote patients.