

Original Article

Effect of energy drink consumption on blood glucose level and clotting time: A comparative study on healthy male and female subjects

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Abstract

Background: The energy drink (ED) consumption rapidly increased by youngsters in recent years. It has a high concentration of sugar, caffeine, taurine and other stimulants that enhance the mental and physical activity. The aim of the current study was to evaluate the comparative effects of taurine-based energy drinks on blood glucose (BG) level and Prothrombin time (PT) among healthy male and female subjects.

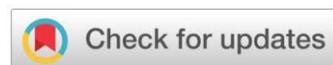
Methodology: A cross-sectional single centre observational study was conducted from over a sample of 50 subjects between 18 to 25 years of age. The subjects were kept in two distinct groups as males and females and all assessments were made individually for both genders. Written informed consent was taken from each subject prior to enrolment in the study. As per the study protocol, the BG level (mg/dl) and PT (sec) were taken twice. Each subject was asked to drink 250 ml taurine based carbonated energy drink after taking the first recording of both (BG level and PT). And secondary records are taken 1 hour after the consumption of ED. The collected data was statistically analyzed using SPSS version 16.

Results: The mean age of the study subjects was 22.34 ± 2.3 years. It was seen that the post-test mean BG level significantly increased to 129.2 ± 18.3 mg/dl (males) and 147.92 ± 24.4 mg/dl (females). Moreover, PT was decreased both in males (96 ± 45.8 sec) and females (78.6 ± 20.2 sec) after ED consumption.

Conclusion: ED consumption contributed to the increased BG level and increased coagulation (decreased PT) and hence indicating an increased risk of thrombosis and type 2 diabetes among persistent consumers. Further large-scale studies are required locally in order to provide sufficient evidence.

Keywords

Energy Drinks, Blood Glucose Level, Coagulation, Prothrombin time, Cardiovascular Affects



Introduction

Energy Drink (ED) consumption has rapidly gained popularity during the last few years and is now being used excessively throughout the world especially by the young population¹⁻³. A single can of ED is known to contain 1000 mg of taurine, 80 mg of caffeine, glucuronolactone, glucose, herbal supplements, sweeteners, vitamins (B group) and etc⁴. Additionally, peanuts, guarana, yerba mate, etc., are also added up in some of the EDs, which directly adds up 300 mg more caffeine content to these beverages^{5,6}. Regardless of the limit acceptable per day, some EDs providing instant energy contain taurine and caffeine 10 times greater than the average daily limit to be ingested. These products are being manufactured and marketed on large-scale, although there are numerous beneficial effects in association with the consumption of EDs like improvement in athletic performance, decreased weight and increased stamina. But the increasing health risks due to the ED components cannot be neglected⁷.

It is mostly used by the adolescents and young adults to prevent drowsiness, for better performance, additional energy and alertness etc². A study also reported exhaustion as one of the leading causes behind the excessive ED consumption². A number of health issues are associated with it, increased pulse rate, insomnia, gastrointestinal disturbances, increase blood pressure (BP), iron deficiency anemia, osteoporosis and cardiovascular diseases are among the most prominent complaints⁸⁻¹⁰.

Furthermore, it also promotes weight gain and dental problems¹¹. Obesity and type 2 diabetes are the two well-known epidemic health conditions, the principal cause behind the promotion of these health hazards is the consumption of caffeine and taurine enriched beverages worldwide¹².

In addition, to the blood glucose, both caffeine and taurine have significant effects on blood coagulation as well. It enhances the platelet activity which in turn increases the cardiovascular risks including arrhythmias, myocardial infarction, and sudden cardiac death^{13,14}. Although the direct mechanism and association is unknown but based on the rapid case filings of sufferers with cardiac problems with associated ED consumption, Food and Drug Administration (FDA) has been strictly investigating the safety of these beverages¹⁵⁻¹⁷. Vast literature is in favor of temporary benefits of ED consumption whereas the negative aspects are yet too explored, prolonged use might cause harmful effects to both physiological and mental health of the consumer¹⁸.

Currently the strong marketing and availability of these harmful energy drinks has provided an open access for the young population. And due to lack of knowledge it is being purchased and consumed extensively. Therefore, the current study was conducted with the aim to explore the effects of ED on blood glucose level and prothrombin time of healthy individuals.

Methodology

This cross-sectional study was performed over a sample of 50 subjects, between the age group 18 to 25 years. While the subjects with any diagnosed neurological or physiological disorder were kept in the exclusion criteria. All ethical protocols were followed and study was initiated after receiving informed consent from each subject, data confidentiality was maintained. The subjects were divided into two groups based on the gender as males and females. And all assessments were made individually for both genders.

Prior to the experimentation, a study questionnaire for details regarding the caffeine and sugar consumption over the previous 12

hours was given to each subject. The blood sugar level was taken once before and then after ED consumption through glucometer. Moreover, the clotting time was also observed and the assessment was carried out by drop method. Each subject was asked to drink 250 ml taurine based carbonated energy drink after taking first recording of both (blood glucose level and clotting time). And secondary records are taken 1 hour after consumption of ED. Data was statistically analyzed using SPSS version 16, mean and standard deviation were used for data interpretation.

Results

Out of 50 enrolled subjects, 25 belonged to each gender with the mean age of 22.34 ± 2.3 years. The BG level (mg/dl) and PT (sec) was assessed both before and 1 hour after ED consumption. It was seen that the BG level was relatively high among females both before and after ED consumption as compared to males i.e. a mean increase of 30.6 mg/dl (males) and 44 mg/dl (females) in BG level after ED consumption was observed. The effect of ED on PT was also prominent, the clotting time significantly decreased among both males (-21 sec) and females (-24.6 sec).

Table I: Comparative effect of energy drink consumption on blood glucose level and clotting time among male and female subjects.

Parameters	Groups	Pre-test	Post-test	Mean difference
BG (mg/dl)	Male	98.6 ± 10.2	129.2 ± 18.3	30.6
	Female	103.92 ± 15.6	147.92 ± 24.4	44
PT (sec)	Male	117.6 ± 116.4	96 ± 45.8	-21
	Female	103.2 ± 57.6	78.6 ± 20.2	-24.6

*Values are given as mean \pm SD.

*BG-Blood Glucose; PT- Prothrombine Time

*Pre-test = Before Energy Drink Consumption; Post-test = 1 hour after Energy Drink Consumption

Discussion

Our findings indicated that ED consumption has significant impact on BG level and coagulation (PT). Based on the recent statistics from a market research report ED have gained much popularity recently which has greatly increased the risk ratio especially among youth. There are a number of physiological and mental variations associated with excessive ED consumption, the high intake leads to altered release of renin, catecholamine and dopamine that stimulates the central nervous system (CNS) increasing the blood pressure (BP) and heart rate (HR)⁸. Therefore, this study was conducted with the aim to evaluate the influence of ED consumption on healthy human body.

According to World health organization (WHO) report, increased taxation on ED would ultimately decrease the consumption and reduce the health risks¹⁹. In support, Fiscal policies for Diet and Prevention of Non-communicable Diseases (NCDs) reports suggested that an overall increase of 20% should be made on all sugary drinks to reduce consumption of these products²⁰. Based on the nutritional aspect, sugar has no significance in diet, it is recommended that the consumption of free sugars is as harmful as a single serving of 250 ml of sugary drinks per day¹⁹.

It is reported that turkey has restricted the ED consumption and under age utilization is strictly controlled recently²¹. While several

other states have banned the under 16 consumption of ED following a warning prompting health effect. Locally, Punjab Food Authority (PFA) has also restricted the manufacture and marketing of ED, i.e. 312 parts per million (ppm) reduced to 200 ppm²¹.

No significant difference was observed between the two genders in terms of alteration in BG level and PT after consumption of energy drinks, although the mean BG level was high among females as compared to males but the increasing pattern was similar among the two genders. The mean BG level among males increased from 98.6 ± 10.2 mg/dl to 129.2 ± 18.3 mg/dl after consuming ED whereas in female's 103.92 ± 15.6 mg/dl increased up to 147.92 ± 24.4 mg/dl (Table 1). Consistent with our findings, a study reported increase in BG level from 82.5 ± 15.1 mg/dl to 99.6 ± 21.0 mg/dl ($p < 0.05$)¹². Furthermore, González-Domínguez and his colleagues in their study showed that the sugar drinks consumption greatly affected BG and insulin levels after 20–30 min, which may due to the synergistic effect of caffeine and sugar²².

Increased coagulation (decreased PT) was observed in response to the ED consumption, a mean decrease in PT in both genders (Table 1). The ED affect the coagulation by directly altering the platelet activity it enhances the platelet aggregation via arachidonic acid, the transformations are visible 1 hour after consumption of ED^{23,24}. Supported by a similar study conducted in Australia, significant decrease in coagulation time was observed following ED consumption i.e. $13.7 \pm 3.7\%$ aggregation before having ED decreased to $0.3 \pm 0.8\%$ aggregation after ED consumption ($p < 0.01$)⁷. Large clinical studies are recommended to further investigate the impact of these EDs on healthy human body, strengthen policies for manufacture and marketing of these harmful beverages and to

propose certain program for management of its excessive consumption.

The major limitation of the study was small sample size, restricted resources and lack of voluntary participation. Such studies should be initiated locally, specifying the frequency of consumption, factors promoting the use, media and social impacts endorsing the consumption of ED. Programs and campaigns must be initiated in order to provide knowledge and awareness regarding negative impacts of these drinks for both the consumers and the manufacturers.

Conclusion

It can be concluded from the study results that excessive ED consumption might cause increase blood glucose concentration and also effects the clotting process. No, significant dissimilarities were observed between the two genders, the variations after ED consumption was in similar trend for both males and females. Hence, excessive ED consumption can cause serious health issues through cardiovascular and metabolic changes, increasing the risk for long-term disease conditions. It is recommended that large scale studies must be conducted to explore ED consumption, its impact and side-effects caused by excessive ED consumption.

Conflicts of Interest

None.

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