Caffeinated Drinks: A Factor of Iron Deficiency in Teenagers(15-19)

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Abstract

The purpose of research was to study the possibility of relationship between iron deficiency and caffeine intake. Simple random sampling method was used to collect samples from local college and school having age between 13—19 years, samples were divided in two groups, 30 samples for both caffeine dependent (CD) and non- caffeine dependent group (NCD). CD sample's consumption of caffeinated drinks was more than 300 mL per day, NCD sample's consumption of caffeinated drinks was less than 200 mL per day. The hemoglobin analysis of the samples determined that the CD samples had low hemoglobin (Hb) levels as compared to NCD samples. The teenager males of CD samples had mean Hb 14.80 while males of the NCD samples had mean Hb 16.80, similar contrast was found in the females of CD and NCD samples. CD samples had mean Hb 11.60 and NCD samples had mean Hb 14.50. It was found from Food frequency graphs showed that the CD samples had more likeness towards cola caffeine drinks, majority of the samples consumed cola caffeine drinks once a day and thrice a day, whereas the NCD samples showed likeness towards tea, majority of the samples consumed tea twice a day.

Key words: caffeine, caffeinated drinks, iron deficiency, hemoglobin (Hb), cola caffeine drinks

Introduction

Iron deficiency is the most common and widespread nutritional disorders in the world, about 2 billion people over 30 % of the world's population are affected by iron deficiency anemia (WHO, 2014). In Pakistan more than 40 percent of total female population is anemic. This includes 35 % girls of 15-19 yrs. of age (PMRC, 1998). Diet as well as a person's nutritional status with respect to nutrients other than iron can have a significant impact on both iron absorption and internal iron metabolism. Interactions between iron and other dietary factors play an important role in determining the adequacy of iron nutrition. (Sean R. Lynch, 1997)The common symptoms of early stages of iron deficiency are feeling tiredness, decreased intellectual performance, reduced resistance to infection and risk for other nutrient deficiencies (CDC, 2013). In the diet, iron has many forms; the two main types are generally described as heme (from hemoglobin and myoglobin in animal tissue) and non-heme iron (including ferric oxides and salts, ferritin and lactoferrin). Heme iron is found in meat and meat products and non-heme iron-present in cereals, vegetables, pulses, beans, fruits in a number of forms ranging from simple iron oxides and salts to more complex organic chelates (Paul Sharp, 2007). Heme Iron Absorption in foods like meat and fish-containing meals is much more successful in human beings than is nonheme iron absorption. But nonheme iron, absorption is increased in in the case of iron deficiency, but the proportional change is much smaller (Sean R. Lynch, 1997).Caffeine, a xanthine alkaloid compound, belonging to family methyl xanthine. Its chemical and systematic name is 1, 3, 7 trimethyl xanthine (Alim-un-Nisa N. Z., 2012). A lethal dose of caffeine is found to be in the range of 200 to 400 mg/kg (Pediatrics, 2011). Energy drinks although the term "energy" can be observed to imply calories, energy drinks typically contain stimulants, such as caffeine and guarana, with varying amounts of carbohydrate, protein, amino acids, vitamins, sodium, and other minerals. Energy drinks are being marketed to children and adolescents for a wide variety of inappropriate use (Pediatrics, 2011). As much as 80 to 300 mg of caffeine and 35 grams of processed 8-ounce of sugar per serving are commonly present in most energy drinks (Ahmed A Alsunni, 2011).Coffee is one of the most popular drinks in the world. It is slightly acidic with pH in range of 5.0–5.1. It shows stimulating effect on humans because of its caffeine content. A coffee bean is a seed of the coffee plant, and is the source for coffee (wikipedia, 2014).Soft drinks are also called cola drinks or carbonated beverage that typically contains carbonated water, a sweetener and a flavoring. Soft drinks also contain caffeine, colorings, preservatives and other ingredients. (wikipedia , 2014).They emerge to be equal in importance to phytates as inhibitors of nonheme iron absorption. The extent of inhibition varies inversely with the condensed polyphenol content. Polyphenols are thought to act through the formation of complexes between the hydroxyl groups of the phenolic compounds and iron molecules, rendering the iron unavailable for absorption. (Sean R. Lynch, 1997)Tea is one of the powerful inhibitor of iron. Tannins are found in tea that increases the inhibition of iron. Polyphenols in tea reduces the bioavailability of nonheme iron when consumed with meals. Tea only inhibits iron absorption when it is consumed at the same time with foods containing nonheme iron (Trevisanato & Kim, 2000).

Caffeine intake has been associated with many adverse effects on human health, these adverse effects are not associated with the intake of caffeine 400 mg/ day, however exceeding the limit can cause toxicity (Diane C. Mitchella, 2014). Deficiencies from chronic dehydration include lack of vitamin B12, Iron and folic acid. Caffeine in coffee also decreases the quality of sleep and thus is one of the main causes of sleep disturbance. (Lutz, 1978).

Aims and objectives

The aims and objectives of the present world are to;

1. Aware to the general population regarding harmful effects of caffeine based products in substantial quality.
2. Study the possibilities of relationship between iron deficiency and caffeine intake.
3. Compare the hemoglobin levels of caffeine dependent and non- caffeine dependent samples.
4. Compare the hemoglobin levels of caffeine dependent and non- caffeine dependent samples.

Material and method

Instrument

UV/Vis spectrophotometer (UNICO UV-2100 united product and instruments Inc, Dayton, U.S.A) with matched cells was used for all spectral measurements, Digital Balance, Pastel mortal.

Reagents and chemicals

All chemicals used were of Analytical Reagent grade purity. Ferrous sulphate (Fe2SO4), distilled water, and ethanol (Merck), were used during this work. Caffeine powder was prepared by grinding Omnidol tablets.

Solution

I. Caffeine solution (500 mL): 130 mg of Omnidol tablets were grinded and dissolved in ethanol 3 mL gradually and continuously stirring, the solution was diluted to 500 mL volumetric flask.
II. Ferrous sulphate solution (1000 ug mL^{-1}): 1.0 g of ferrous sulphate (Fe2SO4) was dissolved in 30 mL of water and diluting up to 100 mL in volumetric flask.

Procedure

The method for spectrophotometric determination is based on the caffeine and iron absorption and complex formation. For analysis from 1000 ug mL^{-1} stock solution of ferrous sulphate 10 mL was taken in 100 mL volumetric flask. To this solution, 1 mL of caffeine solution was added. This product forms a yellow colored charge transfer complex with iron (II), which is soluble in ethanol. The absorbance was measured from 350 to 440 nm using spectrophotometer, for finding the optimum wavelength. Each wavelength was calibrated with blank solution. The absorbance of the complex was measured at 370 nm**.** (Optimum wavelength)

Hemoglobin analysis

A hemoglobin test measures the amount of hemoglobin in the blood. Normal values vary with age and sex. Males have 14.0-18.0 g/dL, while females have levels of 12.0-16.0 g/dL. Hemoglobin analysis was carried out by Sahli-Hellige method. Postprandial blood samples were taken for the test and female samples were tested when they were not menstruating.

Results and discussion

The mean gender for both samples is female mean age for both samples is 17 years, both samples show None of any health problem, BMI for CD samples have 20.6 BMI which means

that the samples are much prone to obesity in near future and NCD samples have 19.6 BMI which is quite good for the sample's age, the mean hemoglobin levels test determine that the CD samples have 11.70 % Hb which shows that majority of the samples are anemic while the NCD samples have 14.30 % Hb. Table 1

Table 1: Descriptive statistics of variables of samples

	N		Minimum	Maximum	Mean
Gender (caffeine dependent)	Male	6			Females
	Female	24			
Gender (Non- caffeine dependent)	Male	6			Females
	Female	24			
Age (caffeine dependent)	30		13	20	17 yrs.
Age (Non- caffeine dependent)	30		15	20	17 yrs.
Health problem (caffeine dependent)	30		2	2	None
Health problem (Non- caffeine dependent)	30		2	2	None
BMI (caffeine dependent)	30		17.0	25.0	20.6
BMI (Non- caffeine dependent)	30		17.0	22.0	19.6
Hemoglobin (caffeine dependent)	Males		11.00	17.80	14.80
	Female		9.95	12.9	11.60
Hemoglobin (Non- caffeine dependent)	Males		14.00	17.00	16.80
	Female		12.0	15.8	14.50

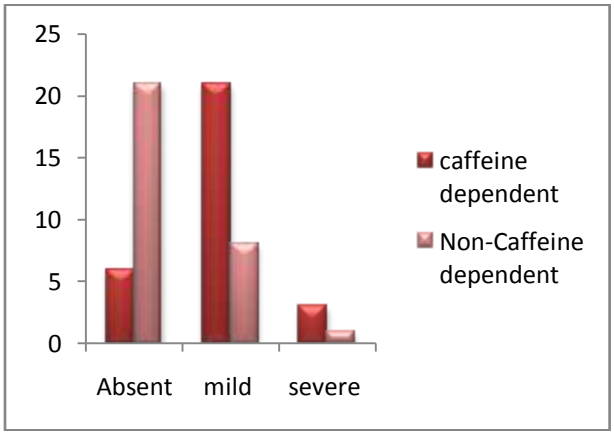

Figure 1 (a)Comparison of Pale Skin between Caffeine Dependent and Non- Caffeine dependent samples

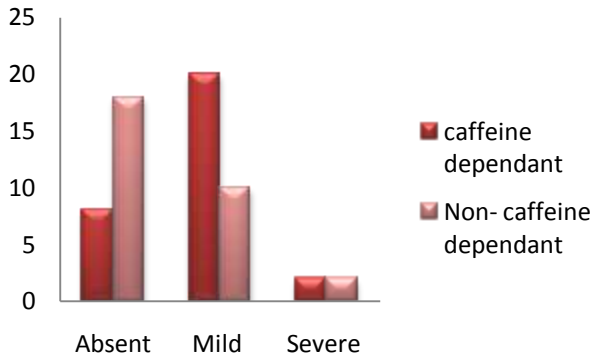

Figure 1(b) Comparison of Weakness between Caffeine Dependent and Non- Caffeine dependent samples

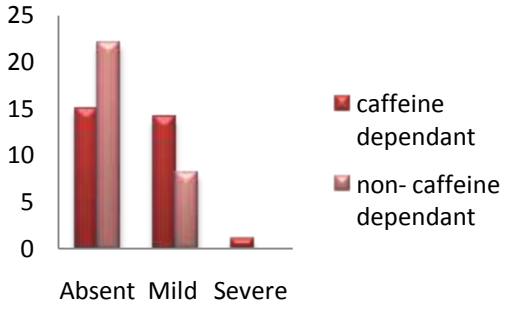

Figure 1 (c) Comparison of Weight Loss between Caffeine Dependent and Non- Caffeine Dependent Samples

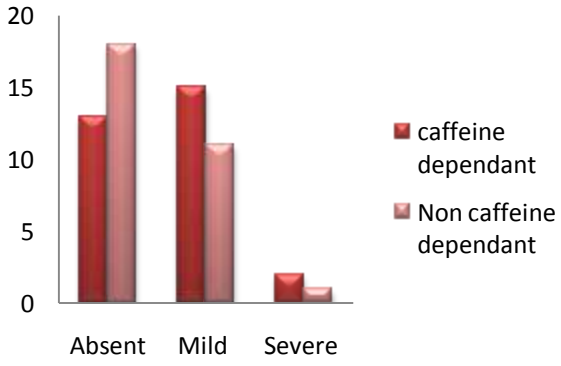

Figure 1 (d) Comparison of Dizziness between Caffeine Dependent and Non- Caffeine Dependent Samples

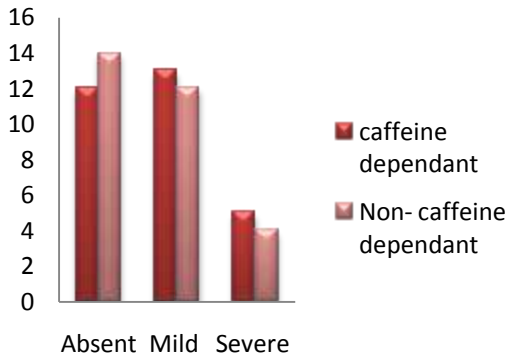

Figure 1 (e) Comparison of Fatigue between Caffeine Dependent and Non- Caffeine Dependent Samples

Fatigue is also a common factor in low hemoglobin samples, the samples show mild fatigue is more common in caffeine dependent samples whereas fatigue is commonly absent in non- caffeine dependent samples, severe type of fatigue is not significant in both caffeine dependent and non-caffeine dependent samples. As shown in Figure 1 (e)

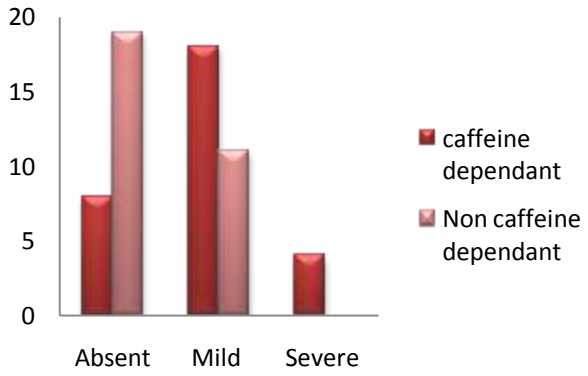

Figure 1 (f) Comparison of Shortness of Breath between Caffeine Dependent and Non- Caffeine Dependent Samples

Many samples of caffeine dependent group show mild type of shortness of breath, where as in non-caffeine dependent samples shortness of breath is commonly absent, none of the samples showed severe shortness of breath in non- caffeine dependent samples. As shown in Figure 1 (f)

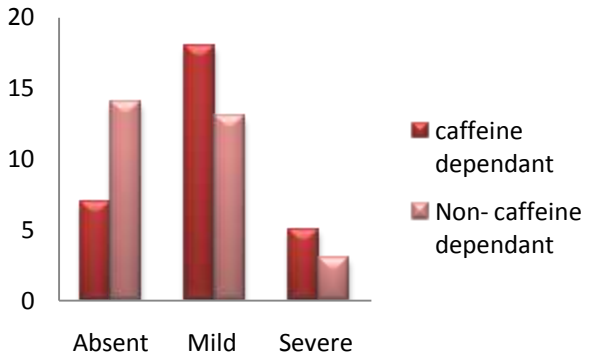

Figure 1 (g) Comparison of Rapid Heart Beat between Caffeine Dependent and Non- Caffeine Dependent Samples

Low hemoglobin symptoms show rapid heartbeat while the samples show mild type rapid heartbeat more common in caffeine dependent samples whereas rapid heartbeat commonly absent in non-caffeine dependent samples, severe type of rapid heartbeat is not significant in both caffeine dependent and non- caffeine dependent samples. As shown in Figure 1 (g)

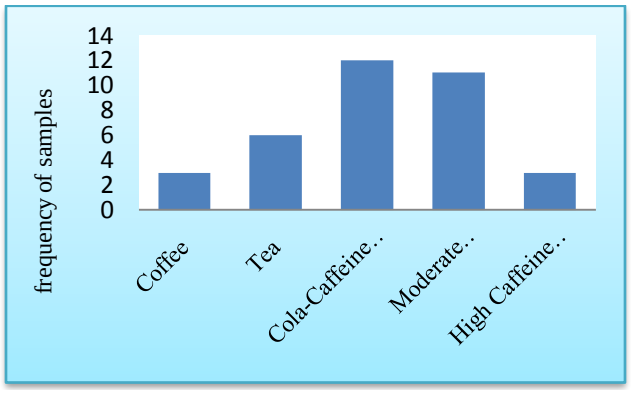

Figure I : Daily Consumption of Caffeinated Drinks by Caffeine Dependent Samples

Daily caffeine consumption of various caffeinated drinks consumed by caffeine dependent samples is important to analyze the majority of caffeinated drinks taken by the teenagers, cola- caffeine drinks where consumed in majority of the samples, while moderate caffeine drinks were also consumed by many of the samples. Figure I

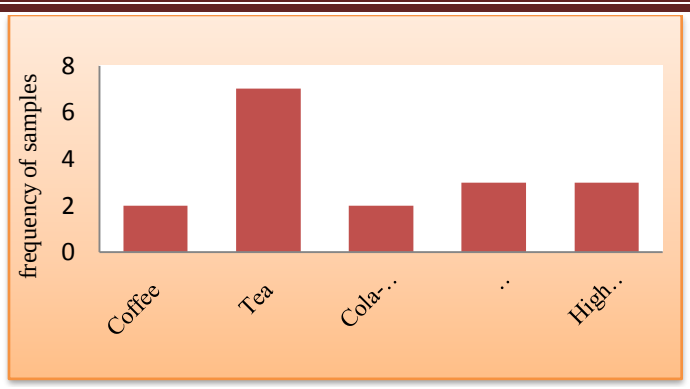

Figure II: Daily Consumption of Caffeinated Drinks by non- Caffeine Dependent Samples

Daily caffeine consumption of various caffeinated drinks consumed by Non- caffeine dependent samples show that Tea was consumed in majority of the samples, while moderate caffeine drinks were also consumed by many of the samples. Figure II.

Conclusion

It is concluded that the samples consuming high levels of caffeine drinks have low hemoglobin levels, the hemoglobin levels for caffeine dependent samples is 11.70 In the comparison to low Hb symptoms the caffeine dependent samples and non- caffeine dependent samples show mild to severe types of pale skin, weakness, weight loss, dizziness, fatigue, shortness of breath, and rapid heartbeat. The food frequency charts caffeine dependent Samples show that the samples consume cola drinks once a day while non- caffeine dependent group show that most of most of the samples consume tea twice a day. (mean), while the non- caffeine dependent samples shave 14.30 (mean), which shows that consuming high levels of caffeinated drinks has adverse effect on hemoglobin level.

Hence, it can be concluded that the binding of iron with caffeine is possible.

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