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AN INVESTIGATIVE STUDY ON CONSUMPTION OF CAFFEINE INTAKE ON SUGAR METABOLISM AMONG ELITE TIGRAY REGION ATHLETES AND CYCLISTS IN ETHIOPIA.

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Abstract
The purpose of this study was to evaluate the effect of coffee on elite athletes and cyclists of Tigray region in Ethiopia. The subject of 24male (12 athletes and 12 cyclists) were selected purposely. Pre and post test was conducted without caffeine from both groups and after one week second pre and post- test was taken by giving the caffeine. The degree and rate of change in the sugar metabolism as a result of consuming caffeine was statistically analyzed using SPSS with significance set at p=0.05. A paired t-test was used to compare the values within each group prior and after the training program. Following the consumption of caffeine, significant improvements were seen in both groups. In conclusion, participants can improve their performance levels with the optimal level of caffeine dose according to the rule of I.O.C

Keywords: *Caffeine,Sugar Metabolism, Athletes,Cyclists.*

INTRODUCTION

Caffeine is a "controlled or restricted drug" in the athletic world, because urinary levels of greater than12 µg/mL following competitions are considered illegal by the International Olympic Committee (IOC). However, most athletes that consume caffeine beverages prior to exercise would never approach the illegal limit following a competition. Therefore, caffeine occupies a unique position in the sports world. It is an inherent part of the diet of many athletes although it has no nutritional value and also has the potential to be a "legal" ergogenic Aid in many exercise situations.

In addition, investigations examining the effects of caffeine on exercise performance during sprinting (<90 s), intense exercise of short (~5 min) and long duration (~20 min) (Collomp et al., 1990, 1991; Jackman et al., 1996; MacIntosh& Wright, 1995) have appeared. Because caffeine is well known as an ingredient in coffee, there is much confusion, even in research literature, between the effects of caffeine and those of coffee. Coffee contains many other constituents that may also carry health benefits; however, this Review will only address the caffeine-related implications of coffee consumption.

Physiological Effects Caffeine is a pharmacologically active substance and, depending on the amount consumed, can be a mild stimulant to the central nervous system. [Mandel, 2002] Caffeine is not alone in this respect. It is one of several ingredients in foods capable of exerting pharmacological and physiological effects. For example, capsaicin in hot peppers causes the familiar burning sensation that often evokes sweating.

When caffeine is consumed orally, it is rapidly absorbed into body fluids and distributed throughout the body in its "water phase" (i.e. blood, urine etc.). Additionally, it is recognized that caffeine readily passes through the blood-brain barrier, enabling it to exert physiological changes. [Institute of Medicine, 2001] Elimination of caffeine from the body is accomplished mainly through metabolism in the liver in a relatively short time; the average half-life, or time taken for the body to eliminate one-half of the amount consumed, is five hours. [Donovan and Devane, 2001]

Caffeine appears to enhance performance during sub maximal intense cycling lasting ~45 min in the laboratory and in simulated 1500 m race time of athletes. Since ergogenic effects of caffeine have been reported with doses of 3-6 mg/kg, it is easy for endurance athletes to enhance performance "legally" with caffeine. Athletes would have to abstain from caffeine ~48-72 h prior to competition to achieve this goal. The researcher suggested on the basis of his work that caffeine should be banned taking few hours prior to competitions in endurance athletes and cyclists. This would ensure that no athlete had an unfair advantage on race day but would not prevent caffeine use in training. Nevertheless, the potential ergogenic effect of caffeine is impressive. On the other hand, discouraging caffeine use counteracts the "win-at-all-costs" mentality.

1.2. STATEMENT OF THE PROBLEM

Recently, major challenges encountering athletics sports are the use of doping and related activities. So, Each and every one can have different responses to caffeine and these responses can vary greatly depending on the dose. It is important for each individual to test the effect of caffeine-containing products carefully and always test them out in training before deciding to use them in competition. and the other main thing that initiate the researcher is the athlete`s misconception towards coffee. Hence the research scholar interested to carry out a study entitled on "An investigative study on consumption of Caffeine Intake on Sugar Metabolism among Elite Tigray region Athletes and Cyclists in Ethiopia".

Objectives Of The Study

This study has been conducted with following objectives in perspective:

a)To analyze and compare effects of caffeine on sugar metabolism among elite Tigray region athletes and cyclists.

b)To analyze the level of metabolism from the two groups (athletes and cyclists).

c)To analyze the level of sugar metabolism of athletes and cyclists withcoffee and without coffee.

Hypothesis of the study

On the basis of evidence available in the literatureso far and with personal experience as well as discussion with experts it is hypothesis that:

H_{01}: There is no difference between the athletes and cyclist on the level of sugar metabolism when caffeine is consumed.

H_{02}: There is no relationship between the athletes and cyclists.

Limitations Of The Study

The researcher recorded the following short comings while conducting the study.

a)Since the subjects were not been from the same residential place, it was not possible to control their day- to- day activities.

b)As the subject participated in this study belongs to various weredas (places) of tigray region the factors such as geographical condition and diet nutrition etc. it could not be control by the researcher but they will be from two clubs of tigray region.

c)Diet plays an important role for improving one's growth and development as well as psycho-physiological responses. This experiment, in fact, failed to control this aspect.

REVIEW OF RELATED LITERATURE

The Researcher has tried to scan the available literature to selected studies, which were directly related to the present study. An attempt has been made to present a summary review of literature, which may be help in understanding and bringing out meaningful outcomes from this study. The following related references have been reviewed as under:

Candow D. Et al. (2009) has carried out a study on Effect of sugar-free Red Bull energy drink on high-intensity run time to-exhaustion in young adults. Consuming sugar-free Red Bull energy drink before exercise has become increasingly popular among exercising individuals. The main purported active ingredient in sugar-free Red Bull is caffeine, which has been shown to increase aerobic exercise performance. The purpose of this study was to determine the effects of sugar-free Red Bull energy drink on high-intensity run time-to-exhaustion in young adults. Physically active university students (n = 17, 9 men,8 woman; 21 6 4 years, 73.4 6 3.1 kg, 175.1 6 3.2 cm) participated in a double-blind, crossover, repeated-measures study where they were randomized to supplement with sugar free. Red Bull (2 mg_kg21 body mass caffeine or ~147 mg caffeine; 4 kcal/250ml) and non caffeinated, sugar-free placebo (lemon-lime flavored soft drink, tonic water, lime juice;4 kcal/250 ml) separated by 7 days. Exercise capacity was assessed by a run time-to-exhaustion test at 80% _ VO2max, perceived exertion was assessed immediately after exercise, and blood lactate was measured before and after exercise. There were no differences in run time-to-exhaustion (Red Bull: 12.6 6 3.8 minutes, placebo: 11.8 6 3.4 minutes), perceived exertion (Red Bull: 17.1 6 2.0, placebo: 16.6 6 1.8), or blood lactate between groups. In conclusion, sugar-free Red Bull energy drink did not influence high-intensity run time-to exhaustion in young adults.

Salome A. (2011) experimented on "Coffee and tea consumption in relation to inflammation and basal glucose metabolism in a multi-ethnic Asian population" Rebello et al. Nutrition, Higher coffee consumption has been associated with a lower risk of type 2 diabetes in cohort studies, but the physiological pathways through which coffee affects glucose metabolism are not fully understood.The aim of this study was to evaluate the associations between habitual coffee and tea consumption and glucose metabolism in a multi-ethnic Asian population and possible mediation by inflammation. We cross-sectionally examined the association between coffee, green tea, black tea and Oolong tea consumption and glycemic (fasting plasma glucose, HOMA-IR, HOMA-beta, plasma hba1c) and inflammatory (plasma adiponectin and C-reactive protein) markers in a multi-ethnic Asian population (N = 4139). After adjusting for multiple confounders, we observed inverse associations between coffee and HOMA-IR (percent difference: - 8.8% for ≥ 3 cups/day versus rarely or never; Ptrend = 0.007), but no significant associations between coffee and inflammatory markers. Tea consumption was not associated with glycemic markers, but green tea was inversely associated with plasma C-reactive protein concentrations (percent difference: - 12.2% for ≥ 1 cup/ day versus < 1 cup/week; Ptrend = 0.042).

Hadi B. Et.al (2013) "Glucose and Blood Lactate Levels Change after Caffeine Supplementation during1-km and 20-km of cycling ". The purpose of this study was to examine the effect of caffeine supplementation on glucose and blood lactate levels after 1 and 20-km cycling. 15 time trial cyclist from Shiraz province participated in this research. In the first stage, subjects received placeboes at three intervals (30 minutes before, 5 minutes before, and immediately after the 1 and 20-km cycling). In the second and third stages (with a 5-day interval between each two stages), all the subjects received caffeine gum with two different doses (180 and 300 mg) at three intervals, likes the first stage. The participants were instructed to chew the gum for 5 minutes. Blood glucose and lactate of the subjects were measured in all three stages, 5 minutes before and immediately after performing the tests. The results of repeated measureANOVA and Tukey's post hoc test indicated that both doses of caffeine have a significant effect on blood lactate and glucose levels after 20-km cycling, but in 1-km cycling group glucose levels did not have significant differences between pre and post test. In conclusion, based on the results of the research, caffeine can affects on glucose and lactate level after endurance cycling, but not after semi endurance cycling. It is possible that the nature of endurance exercise besides caffeine supplementation can affect on glucose and blood lactate levels after exercise.

Donrawee L.et.al (2013) "Effects of Acute Caffeinated Coffee Consumption on Energy Utilization Related to Glucose and Lipid Oxidation from Short Sub maximal Treadmill Exercise in Sedentary Men "1Oxidative Stress, Nutrition and Exercise Biochemistry Laboratory, Department of Physical Therapy, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai 50200, Thailand. 2College of Sport Sciences, Burapha University, Bangsean, Chonburi 20131, Thailand. Corresponding author email: nuttakan@chiangmai.ac.th Aim of this study was to evaluate the short term effect of coffee drinking on energy utilization in sedentary men.This study was performed in healthy sedentary men, who were randomized into three groups, control (n = 6), decaffeinated (n = 10), and caffeine (n = 10). The caffeine dose in coffee was rechecked and calculated for individual volunteers at 5 mg/kg. Baseline Before drinking, complete blood count (CBC), glucose, antioxidant capacity, lipid peroxide, and caffeine in blood was evaluated. After Drinking coffee for 1 hr, the sub maximal exercise test with a modified Bruce protocol was carried out, and the VO2 and RER were analyzed Individually at 80% maximal heart rate, then the blood was repeat evaluated. Three groups showed a non significant difference in CBC results and physical characteristics. The caffeine group showed Significant changes in all parameters; higher VO2 levels, (P = 0.037) and lower RER (P = 0.047), when compared to the baseline. Furthermore, The glucose level after exercise test increased significantly (P = 0.033) as well as lipid peroxide levels (P = 0.005), whereas Antioxidant capacity did not change significantly (P = 0.759), when compared to the before exercise testing. In addition, the blood Caffeine Level also increased only in the caffeine group (P = 0.008).

RESEARCH DESIGN

As every research demands a systematic methods and procedure, like- this chapter adopts the following procedure including information regarding research design, sources of data, selection of subjects, sampling method, selection of test and criterion measures, administration of tests and collection of data, etc. a research become successful accompanied and supported by some reliable and authentic data. The statistical analysis of the gathered data provides a well knit picture of complete and successful hypothesis as pre – stated by the researcher. The chapter has been divided into the following headings.

Experimental design

The design of the experiment was planned in three phases.
Phase – I: Pre test- Exercise- Post test (without caffeine)
After one week
Phase – II: Pre test – Exercise- Post test (with caffeine)
After one week
Phase – III: Pre test -Exercise- Post test (without caffeine)
Phase – I: Pretest- Exercise-post-test (without caffeine)

As the purpose of the study was to see the effect of caffeine on sugar metabolism between athletes and cyclist, all the subjects of experimental groups were exposed to related standard tests to record the pretest data. In the first step blood sample was taken from all subjects and the test one was conducted without coffee (non-coffee) however, after 45 minutes of regular training as per their schedule at sub maximal level, and the again blood sample was taken to check the sugar metabolism level.

Phase – II: Pretest – Exercise- Post-test (with caffeine) after one week of the first test.

A cup of coffee (non- sugar) was given to all subjects, coffee was boiled at a temperature of 55 -75 oc. After consumption of coffee blood was taken. Subjects were undergone for 45 minutes of training at sub maximal level after training blood sample was collected. Both the pre and post test data were conducted with the help of the laboratory professionals.

Phase – III: Pretest – Exercise- Post-test (without caffeine) after one week of second test to check wither the caffeine has long term effect or not.

The procedure for conducting the test was same as the first test was carried out, the blood samples were collected from the subjects and pre and post test was conducted and data was recorded systematically.

ANALYSIS OF DATA AND RESULTS OF THE STUDY

In this chapter, the collected data's was analyzed by employing statistical software. The data was presented through tables systematically. The step-wise results along with scientific as well as logical interpretations have been presented in this chapter. Further, the results were discussed and justified with sound reasoning to draw definite conclusions.

To study the effect of coffee on sugar metabolism between athletes and cyclist, the result of Mean and Standard Deviation has been presented in Tables 1.1 -1.7

Table(1) Descriptive Data Analysis Of Pre Test Without Coffee Intake On Sugar Metabolism Between Athletes And Cyclist

Group	Mean	Std. Deviation	Minimum	Maximum
Athletes	99.75	2.49	97	105
Cyclists	98.33	2.84	94	104

The descriptive statistics as presented in Table 4.1reveals that the Mean and Standard Deviation for athletes and cyclist were (99.75 ± 2.49), (98.33 ± 2.84), minimum and maximum values were (97±105) (94±104) remained in normal range.

Table(2) Descriptive data analysis of post test without coffee intake on sugar metabolism between athletes and cyclist

Group	Mean	Std. Deviation	Minimum	Maximum
Athletes	104.50	2.88	102	109
Cyclists	103.25	3.31	99	109

The descriptive statistics of table 4.2 show that the Mean and Standard Deviation for athletes and cyclist were (104.50 ± 2.88), (98.33 ± 2.84), minimum and maximum values were (102±109) (99±109) remained in normal range.

Table(3) Descriptive data analysis of pre test with coffee intake on sugar metabolism between athletes and cyclist

Group	Mean	Std. Deviation	Minimum	Maximum
Athletes	100.92	2.19	97	104
Cyclists	99.33	2.27	94	104

The descriptive statistics as presented in Table 4.3reveals that the Mean and Standard Deviation for athletes and cyclist were (100.92 ± 2.19), (99.33 ± 2.27), minimum and maximum values were (97±104) (94±104) remained in normal range.

Table(4) Descriptive data analysis of post test with coffee intake on sugar metabolism between athletes and cyclist

Group	Mean	Std. Deviation	Minimum	Maximum
Athletes	129.67	2.50	127	132
Cyclists	129.75	1.96	127	133

The descriptive statistics as presented in Table 4.5 reveals that the Mean and Standard Deviation for athletes and cyclist were (129.67 ± 2.50), (129.75 ± 1.96), minimum and maximum values were (127±132) (127±133) remained in normal range.

To compare the coffee intake and sugar metabolism between athletes and cyclist, the result has been presented in Tables

Table(5) Comparison of pre test mean value on sugar metabolism without coffee between athlete and cyclist

Group	N	Mean (S. D)	Df	MD	SE_M	t-value
Athletes	12	99.75 (2.49)	22	1.42	1.09	1.29
Cyclist	12	98.33 (2.84)				

*Significant at 0.05, $t_{0.05}$ (22) = 2.07

It is evident from table4.1 that pre-test without coffee intake between athletes and cyclist score showed insignificant changes in sugar metabolism as the obtainedby't' ratio 1.29 is less than tabulated value 2.07 with 22 degree of freedom and the level of significance was 0.05.Resulting of this confirm that without consumption of coffee shows no change between athletes and cyclist on sugar metabolism.

Table(6) Comparison of post test mean value on sugar metabolism without coffee between athlete and cyclist

Group	N	Mean (S. D)	Df	MD	SE_M	t-value
Athletes	12	104.50 (2.87)	22	1.25	1.26	0.68

Cyclist	12	103.25 (3.30)				

*Significant at 0.05, $t_{0.05}$ (22) = 2.07

It is evident from table-4.2 that post-test without coffee intake between athletes and cyclist score showed insignificant changes in sugar metabolism as the obtained 't' ratio 0.68 is less than tabulated value 2.07 with 22 degree of freedom and the level of significance was 0.05.Resulting of this confirm that without consumption of coffee shows no change between athletes and cyclists on sugar metabolism.

Table (7) Comparison of pre test mean value on sugar metabolism with coffee between athlete and cyclist

Group	N	Mean (S. D)	Df	MD	SE_M	t-value
Athletes	12	100.92 (2.19)	22	1.59	0.91	1.74
Cyclist	12	99.33 (2.27)				

*Significant at 0.05, $t_{0.05}$ (22) = 2.07

It is evident from table4.5 that pre- test with coffee intake between athletes and cyclist score showed insignificant changes in sugar metabolism as the obtained by 't' ratio 1.74 is less than tabulated value 2.07 with 22 degree of freedom and the level of significance was 0.05.Resulting of this confirm that consumption of coffee shows no change in pre-test between athletes and cyclist on sugar metabolism.

Table (8) Comparison of post test mean value on sugar metabolism with coffee between athlete and cyclist

Group	N	Mean (S. D)	Df	MD	SE_M	t-value
Athletes	12	129.67 (2.50)	22	0.08	0.92	0.91
Cyclist	12	129.75 (1.96)				

*Significant at 0.05, $t_{0.05}$ (22) = 2.07

It is evident from table 4.4 that post test with coffee intake between athletes and cyclist score showed insignificant changes in sugar metabolism as the obtained by 't' ratio 0.91 is less than tabulated value 2.07 with 22 degree of freedom and the level of significance was 0.05.Resulting of this confirm that consumption of coffee shows no change in post test between athletes and cyclist on sugar metabolism.These scores reveal that athletes and cyclist participated in this study bear similar performance level.

Table (9) Comparison of post test mean value on sugar metabolism with and without coffee among athletes

Condition	n	Df	Mean (S.D.)	MD	SE_M	"t" value
Post test Without coffee	12	11	104.50 (2.88)	25.17	0.99	-25.19* (p<0.05)
Post test with coffee	12		129.67 (2.50)			

*Significant at 0.01, $t_{0.05}$ (11) = 3.10

It is evident from table-4.9 that post test with and without coffee intake among athletes score showed significant changes in sugar metabolism as the obtained by 't' ratio 25.19 is greater than tabulated value 3.10 with 11 degree of freedom and the level of significance was 0.05.Resulting of this confirm that consumption of coffee shows a great change among athletes on sugar metabolism.

Table (10) Comparison of Post test Mean value on sugar metabolism with and without coffee among cyclist

Condition	n	Df	Mean (S.D.)	MD	SE_M	"t" value
Post test Without coffee	12	11	103.25 (3.31)	26.50	1.18	-22.38* (p<0.05)
Post test with coffee	12		129.75 (1.95)			

*Significant at 0.01, $t_{0.05}$ (11) = 3.10

It is evident from table-4.10 that post test with and without coffee score showed significant changes in sugar metabolism as the obtained 't' ratio is greater than tabulated value 3.10 with 11 degree of freedom and the level of significance was 0.05 resulting of this confirm that consumption of coffee shows a great change on sugar metabolism among cyclist.

Table (11) Comparison of Post test mean value on sugar metabolism with coffee between Athlete and Cyclist

Group	N	Mean (S. D)	Df	Mean Difference	SE_M	t-value
Athletes	12	129.67 (2.50)	22	0.08	0.92	0.91
Cyclist	12	129.75 (1.96)				

*Significant at 0.05, $t_{0.05}$ (22) = 2.07

DISCUSSION OF FINDINGS

The findings of the statistical analysis have shown dominant role on effect of coffee intake on sugar metabolism among athletes and cyclists. Research scholar is of view that the findings have more than justified the purpose, for which the study was mainly taken up.

The findings indicated that 6mg/kg-1 caffeine supplementation have significant effect on metabolism of sugar.

The results of present study are reported for 24 athletes (12 athletes and 12 cyclists) with the mean age of (athletes) 25 ±1and 24±1,

2.65 years and mean BMI (body mass index of athletes 19.62 ± 1.5 Kg.(m2)-1and 20.65kg(m^2). No significant differences were observed.

CONCLUSION

The moderate doses of caffeine ingested 45 minutes prior to exercise enhance the performance of the athletes and cyclists by metabolizing of sugar level of endurance exercise in the laboratory.

Moderate caffeine doses produce urinary caffeine levels well below the allowable limit, as determined by the International Olympic Committee. The results are specific to well-trained elite cyclists and athletes.

It is not known if these findings will improve performance in competitions because controlled field studies of the effects of caffeine are lacking.

Caffeine appears to enhance performance during sub maximal intense cycling lasting ~45 min in the laboratory and in simulated 1500 m race time of athletes. Since ergogenic effects of caffeine have been reported with doses of 3-6 mg/kg, it is easy for endurance athletes to enhance performance "legally" with caffeine. Athletes would have to abstain from caffeine ~48-72 h prior to competition to achieve this goal. The researcher suggested on the basis of his work that caffeine should be banned taking few hours prior to competitions in endurance athletes and cyclists. This would ensure that no athlete had an unfair advantage on race day but would not prevent caffeine use in training.

The major finding in this study is that there was no significant difference between the cyclist Group and the athletes Group. However, although it was not the purpose of this study to prove a particular point of view, it is likely that the results would have been different if the sample size in each Group 12 had been used. What is important is that, while both the cyclist Group and the athletes Group showed the appearance of an improvement in the caffeine ingestion time trials compared to the non caffeine time trials. In conclusion, caffeine in a performance bar can significantly improve physical and mental ability during and after endurance exercise. It is notable that the improvement in cognitive performance with caffeine was still present after the ride to exhaustion, although participants exercised for longer in the trial with the caffeinated bars. Caffeine is no longer on the prohibited list of the World

Anti-Doping Agency, but its use in competition is monitored.

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