Analysis of the optimal caffeine dose effects on numerical computing reactography

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Abstract: Drinking coffee at special time makes us believe that consumers obtain beneficial experiences to change their mind or body capability. The paper attempts to experience the psycho stimulating effects of edible caffeine as one of the abundant neurotropes used in different nations and identify effective optimum doses. In this research, software was designed based on a definite algorithm titled as "Reaction Time Test" (RTT). The images of the emergency of numbers are being imaged based on neural structure of optical temporal and nozzle just in one of the brain hemispheres. Typically the least reaction time is occurred when the optimal number and one of the triple numbers both are appeared in the middle of the screen. Thus the mentioned number is imaged in both hemisphere and deciding about it is done rapidly due to the presence of data in both hemispheres and the reaction time in comparison with other possible cases is reduced considerably. In groups 1 to 4, there is not a meaningful difference between time reaction average before and after consuming edible caffeine. In group 5, there was a meaningful difference between time reaction average before and after consuming edible caffeine. In group 6 to 9, after drinking edible caffeine, there was a meaningful difference between reaction time average before and after consumption.
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1. Introduction

More than half of people in the world (more than 90% in America and about 70% in Europe) use coffee, tea, chocolate and different beverages. But they are not totally aware of the reason to choose the beverages; maybe natural taste is one of the reasons to use these beverages. Coffee was registered as Arabic wine in Europe since 17th century (Frischknecht, P. M. et.al. 1986) and in 1819 pure caffeine was separated relatively from coffee ingredients. Today, Global consumption of caffeine has been estimated at 120,000 tones per year this amounts to one serving of a caffeinated beverage for every person every day (James, Je; et.al. 1983). The most important source of caffeine is coffee bean. The amount of caffeine is different in coffee and depends on the type of bean and its preparation method (Baumann, T. W; et.al, 1984). Roasting decreases caffeine in coffee (Matissek, R. 1997).

Caffeine stimulates the central nervous system first at the higher levels, resulting in increased alertness, faster and clearer flow of thought, increased focus, and better general body coordination (Nehlig, A, et.al.; 1992) and in addition caffeine is considered metabolic stimulant (Bolton, P.D. 1981).

Caffeine is metabolized in the liver by the Cytohormone Pt50 oxidas enzyme system into three primary metabolites: theophtylline %84 (it relaxes smooth muscles of the bronchi), (12%) theobromine (it dilates blood vessels and increase urine volume) and 4% paraxantine (It increases lipolysis which results in an increase in free fatty acid levels in plasma) (Weinberg, BA; et.al.2001).

Caffeine is absorbed by the stomach and small intestine within 45 minutes of ingestion and then distributed throughout all tissues of the body (Escohotado, et.al. 1999) and it can crosses blood-brain barrier (Weinberg, BA; BK Bealer2001) and half life in healthy adults is about 3-4 hours.

The caffeine molecule is structurally similar to adenosine, and binds to adenosine receptors on the surface of cells without activating them (an "antagonist" mechanism of action). As a result, causes the release of the neurotransmitter dopamine that show the simulating effects of caffeine. Caffeine with a different mechanism increases the amount of adrenalin. In addition, caffeine increases serotonin which appears to effect pain perception and improve mood.

Adenosine is produced due to body daily activities and is considered as one of the secondary effects of muscle activities and is combined with adenosine receptors in brain that decreases nerve cells activities and cause sleep. Neural cells can combine with caffeine (as adenosine). Caffeine combines with all adenosine receptors, so the cells lose the

combination with adenosine that result into the increase in brain cells activities (Nathanson, J. A. 1984). Caffeine stops hindering systems in the brain leading into alertness arousal. Blocking adenosine receptors by caffeine causes neural discharge. In this case hypophysis releases some hormones to contradict this event that increases adrenaline secretion from Adrenal glands. The activation of different neural circles by blocking adenosine receptors increase adrenaline production from adrenal gland and finally increases more energy to the total body system and this is the same goal people expect after drinking coffee.

Caffeine by connecting to Ryanodine receptor opens the channel of this receptor and release Ca2+ from endoplasm network. Caffeine effect on this receptor is dependent upon the density of cytosolic Ca2+ and ER (Springhouse, 2005).

Caffeine increases the amount of CAMP in cardio cells and it has the same effect as epinephrine. CAMP acts as a secondary transmitter and activates protein kinase A. The activated Kinase protein increases the sensitivity of cardiomyocyte to calcium and finally increases heart rate. Blockage of adenosine receptors by caffeine has important secondary effects on many groups of neurotransmitter such as dopamine, neuroadrenaline, Glutamate and GABA and etc. Reciprocal reaction between D2 receptors and A2A adenosine is one of some mechanisms that is dependent on adenosine receptors. As by blocking A2A receptor by caffeine, dopamine transfer is increased in D2 receptors. While blocking A1 receptors by caffeine effects dopamine freedom in some places of striatum and cause dose-induced increase in striatum. Dopamine is a neurotransmitter in special parts of brain activating reward centers. (Nehlig, A; et al, 1992). Caffeine increases metabolism in a person and in this case the energy of brain increases. Through a complex physiological process the amount of oxygen in the brain increases resulting into the increase of alertness and mental activity. Caffeine increases neurons discharge in the brain that these neurons send some signals to hypophysis to release some hormones and these hormones release adrenal from adrenaline gland. The combination of adrenaline with dopamine make the person more alert after drinking coffee and this is a good experience for a person (Graham J.R.et al 1954). Today, by MRI and new technologies a complete explanation of the relationship between memory and caffeine is presented (Han ME et al, 2007).

There is evidence that the people who drink coffee every day, has better mental concentration and they can better review the information in their mind and this shows the connection between memory and coffee. People experimentally found that by increasing caffeine their efficiency increase in stressful conditions as test. (Harry G. et al 2007). Caffeine effects prolongs between 3-5 hours in the body. So alertness here is not very long. But the results of drinking coffee cause that information processing gets clear, we have active memory and generally alertness increases (Latini, S; 2001).

In physical activities caffeine increases muscles efficiency and this is done through increasing fatty acids for muscles. So, the required energy for muscle motions is provided by fatty acids and this itself surpasses decrease in glycogen stored in muscles.

2. Performing research

The research is done in research–physiological lab of Mohaghegh Ardebili University. For doing the tests providing the following items is very important:

1- Determination of the amount of caffeine in the existing coffee.

Coffee beans as mostly are decayed at a definite time and are exposed to the growth of microorganisms are being roasted and sold. Roasting coffee beans reduces considerably the amount of the existing caffeine. As our main goal in this research is determining the effective dose of caffeine, we decided to use natural beans of coffee to do the research. Because in addition to the roasting, most of coffee manufacturing companies use different kinds of additives to give flavor, fragrance and attracting more customers and they try to match the taste of consumers with their products. This taste change is done skillfully as the customer doesn't buy the other coffee brands. The natural coffee beans were purchased by one of the commercial companies from Europe and the concentration of the caffeine in one gram of the sample was stated as 40.95mg.

2- Design RTT software program based on physiological information.

To analyze the effect of caffeine doses in subjects, Reaction time test (RTT) was used to analyze reaction before and after drinking coffee based on time change algorithm. The programming method of this software was mentioned before.

3- The computer analysis of the obtained information based on statistical data.

Due to the variety of tests and investigating the effect of caffeine various doses in different people, the test was done on a great number of subjects and computer analysis method was used to apply the results.

All the test stages were done according to Helsinki protocol and the tests were given to the subjects.

The tests were done before noon according to the programs by which subjects were notified.

Two or three persons averagely participated in daily tests. After the entrance of subjects to the lab, at first the required protocol was given to him to be familiar with the test method and finally the subject was required to fill the form. After filling the protocol, the skill to work with the software was considered because most of subjects were less familiar with very quick systems. Being prepared, the subject start the designed program without eating anything and after doing the first stage, the subject was drinking a special dose of caffeine (1mg/kg -1.5mg/kg -2mg/kg -2.5 mg/kg-3mg/kg-3.5 mg/kg- 4mg/kg-4.5 mg/kg-5mg/kg) obtained from dissolution of coffee powder in hot water (150 ML) after passing from filter (To avoid throwing away most of coffee). After about 40 minutes necessary to attract the maximum amount of caffeine and its maximum amount in blood plasma, the subject again starts to work with the software. It is worth to mention that each subject is tested just with one dose of caffeine and is not aware of the amount of consumpted caffeine. According to the proposed program, the subjects should be divided into 10 groups and being tested. The tenth group should use decaffeinated coffee in the second stage. But considering the latest scientific articles about drinking decaffeinated coffee and its disadvantages, and after consulting with nutrition, heart, metabolism, internal glands and nerve experts and according to Helsinki protocol, this group of the tests is eliminated.

3. Results

In this research the results of 400 persons among subjects were analyzed, the subjects were healthy without any acute or chronic diseases. After studying the completed protocols due to some reasons such as continuous consumption of some of drugs and not having enough concentration during the test, the results of about 59 persons were ignored. Of the remaining 341 persons, the results of about 71 persons were ignored due to the quality or quantity of the responses. So, of the total 400 persons were tested, the results of 270 persons were used in statistical analysis. The subjects were divided into 9 groups and each group was divided into 30 persons (n=30) and in sum are divided into 270 persons (Table 1).

Table 1: Reaction time of subjects in first stage in first group

Before	1	2	3	4	5	6	7	8	9	Average
1-1	650	604	613	638	576	679	659	576	589	620.4
2-1	637	563	620	623	605	679	645	529	657	617.5
3-1	662	646	671	625	579	597	645	547	629	622.3
4-1	650	582	663	656	525	619	623	519	622	606.5
5-1	633	554	670	619	543	599	623	543	656	604.4
6-1	660	601	610	667	521	606	641	568	620	610.4
7-1	657	580	669	654	555	683	655	509	643	622.7
8-1	666	600	649	610	597	655	636	573	670	629.2
9-1	649	577	611	620	529	678	642	548	671	613.8
10-1	654	622	633	641	554	659	639	577	598	619.6
11-1	653	567	667	648	603	674	640	529	591	619.1
12-1	668	612	615	642	555	657	648	516	627	615.5
13-1	671	642	675	665	622	655	642	552	662	642.8
14-1	652	598	680	681	538	676	663	588	609	631.6
15-1	653	631	645	678	611	620	682	566	655	637.8
16-1	665	609	677	641	567	687	657	570	650	635.8
17-1	654	597	667	670	597	610	677	571	661	633.7
18-1	670	604	658	681	578	662	671	569	670	640.3
19-1	663	617	702	627	539	654	655	540	640	626.3
20-1	644	610	688	643	576	648	661	582	649	633.4
21-1	659	636	674	639	568	674	662	575	669	639.5
22-1	644	644	665	658	576	686	636	560	658	636.3
23-1	644	589	668	622	556	636	613	570	599	610.7
24-1	621	607	651	643	566	632	641	598	673	625.7
25-1	685	621	593	675	538	703	683	552	660	634.4
26-1	680	657	643	659	580	666	649	579	683	644
27-1	647	661	638	643	569	693	674	597	695	646.3
28-1	679	682	671	654	578	691	588	653	640	648.4
29-1	614	629	648	655	624	627	674	625	674	641.1
30-1	648	662	726	661	586	689	683	603	641	655.4
Average	654.4	613.4	655.3	647.9	570.3	656.4	650.2	566.1	645.6	628.83

The results of reaction tome of subjects of first group 1mg/kg:

Considering the same test method in 9 groups, the investigation of results in first group is mentioned as a sample and in the other groups just the results without referring to the related tables are presented.

The average reaction time of subjects in this stage is calculated as 628.83.

Second stage: After finishing the first stage, the subjects receive 1mg/kg edible caffeine and after about 40 minutes do the test.

The results of first group subjects in second stage, is shown in table 2.

Table 2: Reaction time of first group subjects in second stage

After	1	2	3	4	5	6	7	8	9	Average
1-1	655	583	670	650	581	671	667	577	588	626.8
1-2	576	572	632	623	589	681	653	557	655	615.3
1-3	645	669	619	629	572	609	649	567	637	621.7
1-4	658	589	672	648	580	602	632	580	643	622.6
1-5	639	562	663	639	528	623	645	556	674	614.3
1-6	600	636	650	671	544	659	633	655	671	635.4
1-7	650	602	679	663	582	679	648	550	672	637.1
1-8	674	623	638	656	586	672	629	570	671	635.4
1-9	645	634	674	618	537	670	651	529	683	626.7
1-10	671	598	624	632	548	688	630	573	622	620.6
1-11	646	609	658	653	588	684	650	577	621	631.7
1-12	657	635	608	635	544	636	653	543	651	618
13-1	667	621	683	655	578	648	677	538	654	635.1
14-1	657	607	667	690	530	666	659	599	627	633.5
15-1	600	652	655	657	580	610	689	590	645	630.8
16-1	650	647	662	678	548	680	645	560	647	635.2
17-1	643	588	649	644	587	649	651	598	672	631.2
18-1	666	687	650	678	564	639	697	581	668	647.7
19-1	656	605	689	688	541	623	697	566	653	635.3
20-1	621	622	641	684	523	659	649	587	662	627.5
21-1	661	622	668	559	553	670	670	583	647	625.88
22-1	653	633	671	647	562	671	650	577	670	637.11
23-1	642	566	624	686	585	639	645	632	662	631.2
24-1	654	604	647	635	578	684	620	561	680	629.2
25-1	675	638	644	677	568	674	674	587	685	646.8
26-1	576	682	602	699	573	693	685	561	645	635.1
27-1	655	679	687	617	585	639	665	689	674	654.4
28-1	666	670	693	673	583	679	604	647	689	656
29-1	600	644	672	669	565	633	680	580	633	630.6
30-1	670	575	687	619	605	673	659	597	688	641.4
Average	644.26	621.8	655.93	652.4	566.23	656.76	655.2	582.23	656.3	632.3

The average amount of reaction time in this stage is estimated as 632.3 ms.

Each of the numbers in the tables is the average 180 cases of reaction time of subjects. Thus, the total average in each stage is the result of averaging 48600 cases reaction time of the subjects.

By drinking edible caffeine with the dose of 1mg/kg, the reaction time of subjects is increased in 18 cases and is reduced in 10 cases. In two cases there was no change in reaction time before and after using caffeine. This case shows the different effect of edible caffeine on persons.

Using t test method with pair samples to prove the difference of tests averages after and before using caffeine with the dose of 1mg/kg, we found that there is not a meaningful difference between the average amount of data before and after using caffeine (table 3).

As the meaningful level of two ranges is 0.22 for this hypothesis and this amount is more than Alpha in the meaningful level of 0.05, there is no difference in the reaction time averages before and after using caffeine with the amount of 1mg/kg. These results are shown in diagram 1.

The results of reaction time of the second group subjects (1.5 mg/kg).

By using edible caffeine with the dose of 1.5mg/kg reaction time of the subjects was increased in 19 cases and it was reduced in 11 cases. By pair t test method it was defined that there is not a meaningful difference between the averages of two stages (table 4).

Table 3. The average amount of data before and after using caffeine

	Average of reaction time	Quantity	Average difference	T quantity	Freedom level	Significance level
Before	628.84	9	-3.47	-1.31	8	0.22
After	632.32	9				

Table 4. The averages of two stages

	Average	Quantity	Average difference	T quantity	Freedom level	Significance level
Before	626.7	9	-5.5	-1	8	0.34
After	632.23	9				

As the meaningful level of two ranges is 34% for this hypothesis and this amount is more than the amount of alpha (0.05), there was not a difference between the average of reaction time before and after consuming caffeine in this dose. These results are shown in diagram 2.

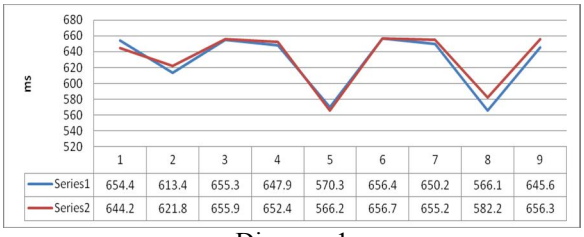

Diagram 1

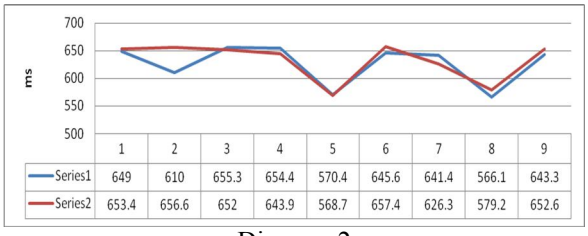

Diagram 2

The results of reaction time of the third group subjects (2 mg/kg).

By using edible caffeine with the dose of 2 mg/kg reaction time of the subjects was increased in 20 cases and it was reduced in 10 cases. By t test with pair samples method defined that there is not a meaningful difference between the averages of reaction time before and after using caffeine (table 5).

According to the results of t test with pair samples to prove the differences of reaction time averages before and after using caffeine in 2mg/kg and as the meaningful level of two ranges is 0.221 for this hypothesis and this amount is more than the amount of alpha, we can say that there was not a difference between the average of reaction time before and after consuming caffeine in 2mg/kg dose. These results are shown in diagram 3.

The results of reaction time of the fourth group subjects (2.5 mg/kg).

By using edible caffeine with the dose of 2.5 mg/kg reaction time of the subjects was increased in 12 cases and it was reduced in 18 cases that show the different effects of edible caffeine on people. Statistical analysis of reaction time tables of the subjects in two previous stages before and after using caffeine by pair t test method with pair samples defined that there is not a meaningful difference between the averages of reaction time before and after using caffeine (table 6).

Table 5. Reaction time before and after using caffeine

	Average of reaction time	Quantity	Average difference	T quantity	Freedom level	Significance level
Before	554.92	9	-4.8	-1.32	8	0.221
After	559.72	9				

Table 6. Reaction time before and after using caffeine

	Average	Quantity	Average difference	T quantity	Freedom level	Significance level
Before	554.4	9	-2.5	-0.23	8	82%
After	556.9	9				

According to the results of t test, the meaningful level of two ranges is calculated 82% for this hypothesis and this amount is more than the amount of alpha in meaningful level of 0.05. We can say that there was not a difference between the average of

reaction time before and after consuming caffeine in this dose. These results are shown in diagram 4.

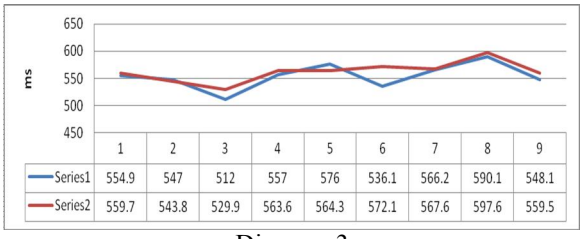

Diagram 3

Diagram 4

The results of reaction time of the fifth group subjects (3 mg/kg).

By using edible caffeine with the dose of 3 mg/kg reaction time of the subjects was increased in 15 cases and it was reduced in 15 cases. Using t test method with pair samples to prove the difference of tests averages after and before using caffeine, we found that there is a meaningful difference between the average amount of two stages of the test, the stage before and after using caffeine in 3mg/kg dose (table 7).

By t test with pair samples prove the difference of tests averages after and before using caffeine, as the meaningful level of two ranges is 0.03 for this hypothesis and this amount is less than the amount of alpha in meaningful level of 0.05. We can say that there was a meaningful difference between the average of reaction time before and after consuming caffeine in 3mg/kg dose. These results are shown in diagram 5.

The results of reaction time of the sixth group subjects (3.5 mg/kg).

By using edible caffeine with the dose of 3.5 mg/kg reaction time of the subjects was increased in 3 cases and it was reduced in 7 cases. T test with pair samples was used for statistical analysis of the data in the mentioned tables defined that there is a meaningful difference between the averages of reaction time before and after using caffeine in 3.5mg/kg dose (table 8).

Table 7. The average amount of two stages of the test, the stage before and after using caffeine in 3mg/kg dose

	Reaction average time	Quantity	Average difference	T quantity	Freedom level	Significance level
Before	507.43	9	-14.98	-2.6	8	0.03
After	522.42	9				

Table 8. Reaction time before and after using caffeine in 3.5mg/kg dose

	Average	Quantity	Average difference	T quantity	Freedom level	Significance level
Before	521.5	9	42.9	7.47	8	0.00
After	478.6	9				

By t test with pair samples to prove the difference of tests averages after and before using caffeine in 3.5 mg/kg dose and as the meaningful level of two ranges 0% for this hypothesis, we can say that there was a meaningful difference between the average of reaction time before and after consuming caffeine. These results are shown in diagram 6.

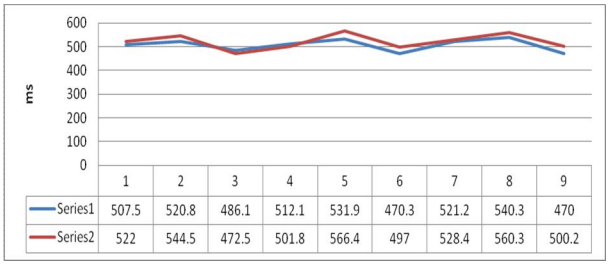

Diagram 5

Diagram 6

The results of reaction time of the seventh group subjects (4 mg/kg).

By using edible caffeine with the dose of 4 mg/kg reaction time of the subjects was increased in 1case and it was reduced in 29 cases. According to the t test with pair samples it was defined that there is a

meaningful difference between the averages of reaction time before and after using caffeine in 4mg/kg dose. Table 9 analyzes the meaningful range of this test.

According to the results of t test with pair samples to prove the differences of reaction time averages before and after using caffeine in 4mg/kg and as the meaningful level of two ranges is 0.000 for this hypothesis and this amount is less than the amount of alpha at meaningful level of 0.05, we can say that there was a difference between the average of reaction time before and after consuming caffeine. These results are shown in diagram 7.

The results of reaction time of the eighth group subjects (4.5 mg/kg).

By using edible caffeine with the dose of 4.5 mg/kg reaction time of the subjects was increased in 3 cases and it was reduced in 27 cases. According to the T test with pair samples it was defined that there is a meaningful difference between the averages of reaction time before and after using caffeine (table 10).

Table 9. Analyzes the meaningful range of this test

	Average	Quantity	Average difference	T quantity	Freedom level	Significance level
Before	628.8	9	63.5	9.32	8	0.000
After	565.3	9				

Table 10. According to the T test with pair samples it was defined that there is a meaningful difference between the averages of reaction time before and after using caffeine

	Average	Quantity	Average difference	T quantity	Freedom level	Significance level
Before	627.96	9	35.76	2.14	8	5%
After	592.2	9				

As the meaningful level of two ranges is 5% for this hypothesis and this amount is equal to the amount of alpha in meaningful level of 5%. We can say that there was a meaningful difference between the average of reaction time before and after consuming caffeine in 4.5 mg/kg dose. These results are shown in diagram 8.

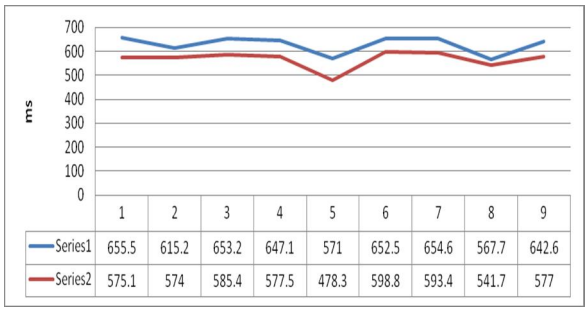

Diagram 7

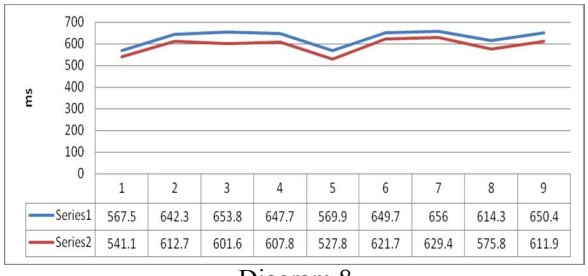

Diagram 8

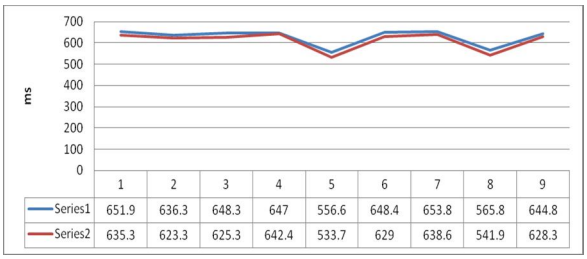

Diagram 9

The results of reaction time of the ninth group subjects (5 mg/kg).

By using edible caffeine with the dose of 5 mg/kg reaction time of the subjects was increased in 1 case and it was reduced in 29 cases. (As 4mg/kg dose).

According to the T test with pair samples it was defined that there is a meaningful difference between the averages of reaction time before and after using caffeine with the dose of 5mg/kg (table 11).

Table 11. According to the T test with pair samples it was defined that there is a meaningful difference between the averages of reaction time before and after using caffeine with the dose of 5mg/kg

	Average	Quantity	Average difference	T quantity	Freedom level	Significance level
Before	628.10	9	17.2	2.21	8	0.5
After	610.9	9				

Table 12.

Group	Caffeine dose	Stage	Reaction time	Average difference	Quantity of group persons	Change rules	Quantity
1	1 mg/kg	Before	628.84	+3.48	30	increase	18
		After	632.3			decrease	12
2	1.5 mg/kg	Before	626.7	+5.5	30	increase	19
		After	632.23			decrease	11
3	2 mg/kg	Before	554.92	+4.8	30	increase	20
		After	559.7			decrease	10
4	2.5 mg/kg	Before	554.42	+2.5	30	increase	12
		After	556.9			decrease	18
5	3 mg/kg	Before	507.5	+14.98	30	increase	15
		After	522.42			decrease	15
6	3.5 mg/kg	Before	521.5	-42.9 *	30	increase	3
		After	478. 6			decrease	27
7	4 mg/kg	Before	628.82	-63.5 *	30	increase	1
		After	565.3			decrease	29
8	4.5 mg/kg	Before	627.96	-35.76 *	30	increase	3
		After	592.2			decrease	27
9	5 mg/kg	Before	628.1	-17.2*	30	increase	1
		After	610.9			decrease	29

* Indicates the meaningful reaction time changes.

As the meaningful level of two ranges is 0.05 for this hypothesis and this amount is equal to the amount of alpha in meaningful level of 0.05. We can say that there was a meaningful difference between the average of reaction time before and after consuming caffeine. These results are shown in diagram 9.

4. Discussions

The first source of caffeine is coffee bean. The amount of caffeine in coffee is dependent upon the type of bean and its preparation amount (Baumann, T. W; et.al, 1984). Coffee increases the brain efficiency. Today, by MRI and new technologies a complete explanation of the relationship between memory and caffeine is presented (Han ME et al, 2007).

Caffeine increases the mental alertness (Graham J.R.et al 1954. Using caffeine is related to some of the character differences. Brain scans show the increasing activities of especial parts in the brain that is connected to the data storage in short term memory. Using edible caffeine also has positive effect on active memory 9Latini, S; et al, 2001).

Today caffeine consumption is increased while consumers are not aware of the amount of caffeine daily used or optimum dose of edible caffeine (James, Je; et.al. 1983).

In this research many subjects were used for the application of computer analysis method (270 persons). The analysis of the results show that the effect of caffeine is different in different people and this proves the above items. This result is important from the point that all the subjects were student and they had little differences from mental capabilities but the close mental physiological levels didn't hinder the variety of the effect of caffeine and its different effects was approved in different people. The results of the tests indicated that reaction time average after using doses, 2mg/kg, 2.5mg/kg, 3mg/kg, 1.5mg/kg, 1mg/kg is increased but in doses 4.5mg/kg, 4mg/kg, 3.5 mg/kg, 5mg/kg reaction time average of the subjects after using edible caffeine is reduced meaningfully. This reduction in dose 3.5 mg/kg is calculated as 42.5ms while in dose 4 mg/kg this reduction is changed into 63.5. In dose 4.5 mg/kg reaction time reduction is 37.5 ms and this change in dose 5mg/kg reaches 17.2 mg/kg. In addition, the number of subjects whose reaction time average after using 4.5 mg/kg, 4 mg/kg, 3.5 mg/kg, 5 mg/kg doses of edible caffeine is reduced, is more than the group whose reaction time is increased that is always showing the different effects of caffeine in different people. Therefore, the new doses reduce reaction time in subjects. By a careful consideration of the reaction

time changes it can be said that the changes start from 3.5 mg/kg dose and in 4mg/kg dose the maximum reduction is observed and in doses 4.5 mg/kg and 5 mg/kg despite the reduction of reaction time before and after using edible caffeine its effects are reduced. These changes are shown clearly in table 12.

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