Progress in Nutrition 2022; Vol. 24, Supplement 1: e2022074 DOI 10.23751/pn.v24iS1.13022

Original article

The Effects of 8-Week Intensive Interval Exercises Applied in the High-Altitude Camp Centre on Some Performance Parameters of National Cross Country Crossers

Cemal Berkan Alpay, Burak Yücel

Ağrı İbrahim Çeçen University, Faculty of Sports Sciences, Ağrı, Turkey

Abstract. *Study Objectives:* In this study, it was aimed to examine the effects of 8-week intensive interval exercises on some performance parameters, applied to male and female national crossers in the high-altitude camp center during the preparatory period. *Methods:* Totally, 12 male and 13 female athletes between the ages of 18-24 who continue to compete in the national cross-country teams of Turkey participated in the study. Anaerobic power, speed, and balance performance values of the athletes participating in the study were measured. *Results:* Statistically significant differences were found in the mean scores of the male participants in the Wingate anaerobic strength test, 30m sprint test, static right, static left, static double leg balance, dynamic right, left, and double leg balance pre-test/post-test scores. While statistically significant differences were found in the mean scores of the female participants in the Wingate anaerobic strength test, 30m speed, static right and double leg balance, dynamic right, left and double leg balance pre-test/post-test scores, no significant results were obtained in the static left leg test. *Conclusion:* As a result of the study, it was determined that intensive exercises applied in the high-altitude camp center improved anaerobic power values, static and dynamic balance values, and speed performance values in both male and female athletes.

Key words: High-Altitude, Athletic Performance, Balance, Anaerobic Power

Introduction

As a result of rapidly developing technologies and a sedentary lifestyle in the world, many people are increasing the frequency of physical activity day by day. This is true for both athletes and non-athletes alike. However, especially athletes, unlike non-athletes, use different methods to achieve more efficient performances, one of these methods is working at high altitudes. High altitude exercises are essential not only for athletes but also for branches related to aerobic and anaerobic endurance. Thus, research on the subject has become more noteworthy in recent years.

The height levels of 1000 meters and above are considered as altitude. The ideal altitude is between 1800-2300 meters and the time to stay at altitude is between 2-4 weeks (1). Exercises at high altitudes should be started with aerobic loads, anaerobic exercises can be done after adaptation to the altitude. High altitude studies were first started in 1878, but no world record was broken in any of the races that ended in more than 2.5 minutes in the 1968 Mexico City Olympics, which is the subject of high altitude. At the same time, it provided an advantage in some of the anaerobic branches (100 meters running, high jump, javelin throw, triple jump, long jump, shot put, etc.) and the records broken in these branches could not be broken for a long time. In these Olympics, it is remarkable that African runners who regularly trained at high altitudes dominated. In the light of this information, it can be claimed that altitude affects aerobic properties or endurance rather than sprint or anaerobic events (2). It is accepted that height training increases general endurance, and it is believed that it can be beneficial (1). The recovery time of the athletes with good general endurance is also faster than those who are not good. It is especially remarkable in tour systems (branches with anaerobic predominance) as the athlete's performance is linked to the level of recovery in the next round.

Anaerobic power can be defined as the ability of the athlete to use the phosphagen (ATP-CP) system during short-term and high-intensity exercises (3). It is stated that anaerobic power and anaerobic capacity are used abundantly in movements such as speed, jumping, agility, and acceleration and are influential factors that determine performance (4,5).

Looking at the body organism, the working capacity of this organism at the highest oxygen deficit is explained as Anaerobic Capacity. The anaerobic capacity levels of the athletes differ according to their training levels, training, and muscle fiber types. The ability of the athlete to convert the energy used per-unit time into power is called anaerobic power. When we examine the measurements made on the athletes, it is usually the power detected in the first 5 seconds. Sometimes, this value may appear in the second 5 seconds, yet it can be detected (6).

One of the most notable bio-motor skills required in sports or sports branches is the ability to move or moving at speed or moving very quickly. From the mechanical point of view, speed is explained by the ratio between distance and time. The term speed/pace includes three elements: reaction time, frequency of movement per unit of time, speed/pace of traveling over a given distance. The correlation between these three factors leads a person to determine their efficiency in an exercise requiring speed. Therefore, the result in a sprint depends on the athlete's initial reaction, the speed at which he travels throughout the entire race (e.g., thrust force), and the stride frequency. It is a speed/pace determining skill in many sports such as sprint racing, boxing, fencing, hockey, team sports, and more (7).

Balance is defined as the protection and maintenance of body posture during movements performed on a moving or stable ground (8). Static balance can be defined as the ability to maintain a position with smaller movements, and it can also be expressed as the ability to maintain it while maintaining the center of gravity on one leg on a flat surface (9,10). Dynamic balance can be defined as the ability of body segments to control the body during and after the transition from a stationary state to a mobile state. Dynamic balance, unlike static balance, can also be defined as the ability to perform a task on a moving surface or while the body is in motion (11).

In the existing literature, in general, the impacts of different atmospheric conditions on the performance of athletes were investigated and it was aimed to reveal possible motor, physical and physiological differences in performance and body (12-16). In the light of the given information, in this study, the effects of 8-week intensive interval exercises applied to 13 female and 12 male athletes in national cross-country teams during the pre-preparation period at a high-altitude camp center were investigated on some performance parameters.

Material and Methods

Totally, 12 male and 13 female athletes in the men's and women's national cross-country teams with at least a European degree participated in the study voluntarily. The content of the study was explained in detail to the participants and the athletes who wanted to participate in the study signed the consent form. The athletes participating in the practiced within the training program for 3 days a week, apart from their branch training. Within the scope of the study program, the first test and post-test measurements of the athletes at the beginning and end of the 8-week training program were determined in Atatürk University Physical and Physiological Test Measurement Laboratory and Ağrı İbrahim Çeçen University Performance Laboratory and Sports Facilities. This study was approved by the ethics committee decision, dated 09.09.2021, and numbered 223.

Design of the Study

The study was performed for 8 weeks, and the athletes included in the training program were given an intensive exercise program 3 days a week for 8 weeks at an altitude of 2300 meters. Wingate anaerobic power test, 30 meters speed test, static balance test (static right foot, static left foot, static double foot), and dynamic balance test (dynamic right foot, dynamic left foot, dynamic double foot) measurements were taken from the athletes both at the beginning and at the end of the 8-week training program.

Training Program

The study is a systematic research model for athletes. The intensive training program was applied 3 days a week to the athletes who were subjected to an 8-week exercise program. Each training lasted 90 minutes and the first 15 minutes of the training consisted of the warm-up, 60 minutes of the main phase, and the last 15 minutes of the cool-down. The 8-week intensive exercise program applied to the athletes is shown in Table 1.

The intensity and resting times of the exercise program applied to the athletes were calculated with the Karvonen formula. (220-age-resting heart rate x training intensity + resting heart rate = maximum heart rate)

Wingate Anaerobic Strength and Capacity Test

It was carried out on a computer-connected mechanical bicycle ergometer (Monark Ergomedics 984 E, Pike Byke, Finland). Before the test, the athletes were shown the videos of the test, detailed information about the test were given and they were warmed up for 5-8 minutes at 60-70 W workload. The amount of load corresponding to 7.5% of each subject's body weight was determined and placed in the weight chamber of the bicycle. After the athletes reached the maximum pedal speed within 3-4 seconds just before the test, the load was applied and the load on the pan was lowered and reflected on the pedals. After the test started, they were asked to accelerate to the maximal pedal speed for 30 seconds. During the test, verbal motivation was provided to the athletes. The test was applied once. Instantaneous peak absolute power (PAP) (peak power measured in the first 5 seconds), anaerobic power (AP) (average power in the first 5 seconds), and anaerobic capacity (AC) (average power measured for 30 seconds) were calculated by the software program on the computer. Fatigue index (FI) was calculated from the formula FI = ((First 5-sec power – Last 5-sec power) / First 5-sec power) x 100 from the average power values recorded in the first and last five seconds.

30m Speed Test

This test was carried out with the New Test 2000 device with millisecond precision. With the help of photocells placed at the start and endpoints, the time starts automatically when the athletes start running and stop automatically when the distance of 30 meters is completed.

Table 1. The 8-Week Intensive Exercise Program

TIME ▶ EXERCISE ▼	1^{st}-2nd week	3^{rd}-4^{th} week	5^{th}-6^{th} week	7^{th}-8^{th} week	REST
WARM-UP	15-20 minutes jogging and stretching	15-20 minutes jogging and stretching	15-20 minutes jogging and stretching	15-20 minutes jogging and stretching	-----------------
MAIN PHASE	4*200 m 4*300 m 4*400 m	5*200 m 5*300 m 5*400 m	6*200 m 6*300 m 6*400 m	7*200 m 7*300 m 7*400 m	Productive Rest / Active between loads
COOLDOWN	15-20 minutes jogging and stretching	15-20 minutes jogging and stretching	15-20 minutes jogging and stretching	15-20 minutes jogging and stretching	------------------

Balance Tests

T Balance tests were carried out using the Kinesthetics Ability Trainer (OEM Medical, SPORKAT 4000, Carlsbad, USA) balance system, which is a type of stabilimeter instrument that can fully reflect balance performance. Athletes first warmed up for 5 minutes on the treadmill with their light sports clothes, and after stretching for a while, they were tested. Before taking the test, the athletes were allowed to practice on KAT 4000 for 3-5 minutes to reduce the learning effect. During the trial, the best balance position of the athletes was determined. During the entire test, the athletes were asked to keep their arms crossed on the chest and bring the knee to 20° flexion. Keeping the arms crossed on the chest eliminates the ballistic effects of arm position. As a result of the measurement, a score was obtained for each equilibrium value.

Statistical Analysis

SPSS 22.00 package program was used for the analysis of the data obtained from the study. A paired-samples t-test was used to analyze the difference between the pre-test and post-test data of the athletes participating in the study in terms of gender, and the level of significance was determined as $p < 0.05$.

Results

When Table 2 is examined, statistically significant differences were found in the mean pre-test-post-test scores of the male participants' Wingate anaerobic power test, 30m, static right, left and double leg balance, dynamic right, left and double leg balance ($p < .05$).

When Table 3 is examined, statistically significant differences were found in the mean pre-test-post-test scores of the female participants in the Wingate anaerobic strength test, 30m, static right and static double leg balance, dynamic right, left, and double leg balance ($p < .05$).

Discussion and Conclusion

In this study, the effect of 8-week intensive exercises on anaerobic power, speed, and balance

Table 2. Comparison Results of the Pre-test/Post-test Mean Scores of the Variables (Male)

Variables	Time of Measurement	X±S.D.	Median (Q_2)	Q_1- Q_3	z	p
Wingate Anaerobic Power	Pre-Test	621.50±54.47	623.70	590.38-671.80	-2.510	.012
	Post-Test	690.21±91.51	702.20	657.78-751.98		
30 m. Speed	Pre-Test	4.23±.38	4.12	4.00-4.29	-2.747	.006
	Post-Test	4.00±.34	3.98	3.73-4.13		
Static Right Leg Balance	Pre-Test	270.83±75.59	255.00	211.00-327.25	-2.510	.012
	Post-Test	225.92±60.59	204.00	176.00-262.75		
Static Left Leg Balance	Pre-Test	166.92±34.69	165.50	144.50-172.00	-2.982	.003
	Post-Test	138.00±32.55	134.00	110.25-157.50		
Static Double Leg Balance	Pre-Test	289.67±144.41	243.00	179.25-356.25	-2.118	.034
	Post-Test	239.17±141.66	184.00	163.25-258.00		
Dynamic Right Leg Balance	Pre-Test	362.25±36.57	368.00	329.75-384.00	-3.059	.002
	Post-Test	283.25±57.66	276.50	231.00-319.75		
Dynamic Left Leg Balance	Pre-Test	1153.83±343.25	1080.00	820.25-1513.75	-3.059	.002
	Post-Test	886.92±240.92	933.00	639.25-1034.00		
Dynamic Double Leg Balance	Pre-Test	865.00±168.56	907.50	815.50-1001.00	-3.061	.002
	Post-Test	676.33±135.57	656.50	608.75-744.25		

Table 3. Comparison Results of the Pre-test/Post-test Mean Scores of the Variables (Female)

Variables	Time of Measurement	$\bar{X}$±S.D.	Median (Q_2)	Q_1- Q_3	z	p
Wingate Anaerobic Power	Pre-Test	648.22±110.73	664.20	582.50-715.45	-3.040	.002
	Post-Test	731.50±116.70	714.50	659.55-841.00		
30 m. Speed	Pre-Test	5.44±.22	5.41	5.28-5.62	-2.692	.007
	Post-Test	5.23±.35	5.32	5.03-5.49		
Static Right Leg Balance	Pre-Test	293.54±93.92	291.00	230.00-348.00	-3.181	.001
	Post-Test	206.92±74.27	193.00	155.50-258.50		
Static Left Leg Balance	Pre-Test	217.77±62.51	212.00	180.00-251.00	-.210	.834
	Post-Test	223.62±82.46	207.00	166.00-267.00		
Static Double Leg Balance	Pre-Test	309.54±69.33	310.00	244.00-356.00	-2.936	.003
	Post-Test	264.31±52.68	247.00	233.00-294.00		
Dynamic Right Leg Balance	Pre-Test	754.38±188.72	814.00	699.50-857.50	-2.481	.013
	Post-Test	654.23±145.31	663.00	539.50- 798.00		
Dynamic Left Leg Balance	Pre-Test	1098.46±284.68	1245.00	851.00-1339.50	-3.180	.001
	Post-Test	891.31±237.97	930.00	660.00-1029.00		
Dynamic Double Leg Balance	Pre-Test	927.62±190.66	960.00	797.50-1019.50	-3.180	.001
	Post-Test	769.46±179.14	863.00	592.00-901.50		

performance parameters of national athletes in the pre-preparation period of Turkey's national cross-country team was investigated. According to the statistical analysis results, significant differences were found in the anaerobic power values of both male and female athletes. Compared to the types of exercise performed in recent years, high-intensity interval training, which improves aerobic capacity, contributes to anaerobic capacity, also benefits body composition, is effective in terms of physical fitness, and has more participation and a shorter effect compared to moderate-intensity exercises (17). Although many researchers say that high-intensity interval training generally improves aerobic capacity, according to other authors, it improves both aerobic and anaerobic capacity (18,19). Considering the existing studies on this subject, Svedenhag (1991) determined that the anaerobic capacity of the subjects increased after 2 weeks of training at an altitude of 2000m (20). In another study, it was determined that the average anaerobic power Wingate 30 sec test values in children living at higher altitudes (3600 m) were lower than those of children living at lower altitudes (330 m) (21). In the study conducted by Álvarez-Herms et al. (2015) on eight individuals for maximal anaerobic capacities at different hypoxia levels, they obtained similar results in average anaerobic power values in normal and moderate hypoxia levels, while higher values in average power outputs in high hypoxia conditions (22). In the study by Meeuwsen et al. (2001) by simulating the hypoxia group at sea level at 2500 m and applying 60-70% of the maximum heart rate to male athletes for 10 days, training on a bicycle ergometer for two hours every day, W max absolute (W;$p < 0.05$) and W max relative (W.kg^{-1}; $p < 0.01$) values significantly increased (23). When the altitude studies are examined, it has been determined that the results obtained are in parallel with our study.

Significant increases were obtained in both the 30-meter sprint performances of male athletes and the 30-meter sprint test performances of female athletes participating in the study. It has been seen that these high-intensity interval training in athletics and other sports branches improve the speed performance of athletes (19,24-26). Speed is more limited to develop comparing to other motor features. It is an ability that is generally dependent on the individual's genetic physiological potential and can be improved (27). Our study shows parallelism with the literature given.

Within the scope of the study, while a significant increase was achieved in the static balance (right leg, left leg, and double leg) test scores of male and female athletes, no significant difference was found in the static left leg balance test scores of female athletes. It is thought that this is since female athletes do not use their left legs more effectively. In the research, it was determined that both male and female athletes had significant increases in dynamic balance (right leg, left leg, double leg) in pre-test post-test scores. Balance is a notable component in athletic performance. Therefore, when applied with interval training, it can reduce the risk of injury by improving both performance and motor control. Hall (1988) investigated the effect of Pilates on static and dynamic balance in 31 elderly men and women and found a significant difference in pre-test and post-test groups as a conclusion of a 10-week study (28). Tsang et al. (2007) found stronger knee muscle strength and balance scores compared to the control group in their study on adults who regularly practice Tai Chi (29). Akçınar (2014) stated that plyometric training applied on male athletes aged 11-12 provides an improvement on the right foot dynamic balance values of the athletes (30). Harput et al. (2016) stated that in female volleyball players with an average age of 15.6 years, interval training improved on the non-dominant foot dynamic balance values of the athletes (31). Kaplan et al. (2020) stated that interval training in the short term of 6 weeks is effective in the development of balance in athletes with an average age of 12.59 years (32). When we have a look at the literature on this subject, it is consistent with the results we obtained from our study.

As a result, it was observed that the application of the intensive interval exercise program at high altitudes for 8 weeks (after adapting to the altitude) improved the anaerobic power, speed, and balance test results of the athletes. At the same time, it can be asserted that the intensive interval training program applied at high altitudes should be included in the annual training programs of athletics and other branches.

Conflict of Interests: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

References

1. Günay M. Spor Fizyolojisi. (2. baskı). Ankara. Bağırgan Yayınevi; 1999.
2. Fox, EL, Bowers R, Foss M. The Physiological Basis of Physical Education and Athletics (5th Ed.). Brown and Benchmark; Dubuque; 1993.
3. Beam WC, Adams GM. Egzersiz Fizyolojisi-Laboratuvar El Kitabı. Ankara; Nobel Akademik Yayıncılık; 2013.
4. Balsom PD, Seger JY, Jödin SB, Ekblom B. Maximal-Intensity Intermittent Exercise: Effect of Recovery Duration. International Journal Sports Medicine. 199213(7):528-33.
5. Casas A. Physiology and methodology of intermittent resistance training for acyclic sports. Journal of Human Sport and Exercise.2008;3(1):23-52.
6. Fox EL, Bowers RW, Foss ML. The Physiological Basis of Physical Education and Athletics. (4th ed.). New York, Saunders Co: 1988.
7. Bompa T.O. Antrenman Kuramı ve Yöntemi I. Dönemleme. (4. Baskı). Ankara: Spor Yayınevi ve Kitabevi: 2011.
8. Kaya M. 13-15 Yaş Grubu Spor Yapan Görme Engellilerin Statik ve Dinamik Denge Etkinliklerinin Karşılaştırılması. Gazi Üniversitesi Sağlık Bilimleri Enstitüsü Beden Eğitimi ve Spor Anabilim Dalı, Ankara: 2003.
9. Guskiewicz KM. Regaining Postural Stability and Balance. In: Prentice WE, Ed. Rehabilitation Techniques for Sports Medicine and Athletic Training. (pp. 156-185) New York, NY: McGraw-Hill Companies: 2004.
10. Ricotti L. Static and Dynamic Balance in Young Athletes. Journal Human Sport Exercise. 2011;6(4):616- 628
11. Arslanoğlu E, Aydoğmuş M, Arslanoğlu C, enel Ö. Badmintoncularda reaksiyon zamanı ve denge ilişkisi. Niğde Üniversitesi Beden Eğitimi ve Spor Bilimleri Dergisi. 2010;4:132-135.
12. Kayser B, Narici M, Milesi S, Grassi B. Body Composition and Max Alactin Anaerobic Performance During A One Month Stay at High Altitude, Maximum Lactic Capacity at Altitude: Effect of Bi-Carbonate Loading. Journal of Applied Physiology. 1993;75:1070-1074.
13. Stenaicker JM. Lung Diffusion Capacity, Oxygen Uptake, Cardiac Output and Oxygen Transport During Exercise Before and after on Himalayan Expedition. European Journal of Applied Physiology. 1996;74(1-2):187-193.
14. Robergs RA, Quintana R, Parker D, Frankel CC. Gender Specific Decrement in VO_{2Max} with Increasing Hypobaric Hypoxia. Medicine And Science in Sports and Exercise. 1997;29(5):135.
15. Weyand PG, Lee CS, Martinez-Ruiz R, Bundle MW, Bellizzi MJ. Wright, S. High-Speed Running Performance Is Largely Unaffected by Hypoxic Reductions in Aerobic Power. Journal of Applied Physiology. 1999;86: 2059–2064.
16. Ogura Y, Katamoto S, Uchimaru J, Takahashi K, Naito H. Effects of low and high levels of moderate hypoxia on anaerobic energy release during supramaximal cycle exercise. European Journal of Applied Physiology. 2006;98:41–47.

17. Sperlich B, De Marées M, Koehler K, Linville J, Holmberg HC, Mester J. Effects of 5 Weeks of High-İntensity İnterval Training Vs. Volume Training in 14-Year-Old Soccer Players. The Journal of Strength Conditioning Research. 2011;25:1271-1278.
18. Arazi, H., Keihaniyan, A., Eatemadyboroujeni, A, et al. Effects of Heart Rate Vs. Speed-Based High Intensity Interval Training on Aerobic and Anaerobic Capacity of Female Soccer Players. Sports. 2017;5(3):57.
19. Howard N, Stavrianeas S. In-Season High-Intensity Interval Training Improves Conditioning in High School Soccer Players. International Journal of Exercise Science. 2017;10:713-720.
20. Svendenhag J. Aerobic and Anaerobic Exercise Capacities of Elite Middle-Distance Runners after Two Weeks of Training at Moderate Altitude, Scandinavian Journal Medicine Science Sports. 1991;1:205-214.
21. Blonc S, Falgairette M, Bedu N. The Effect of Acute Hypoxia at Low Altitude and Acute Normoxia at High Altitude on Performance During a 30-s Wingate Test in Children, International Journal Sports Medicine. 1994;15:403- 407
22. Álvarez-Herms J, Julià-Sánchez S, Gatterer H, Viscor G, Burtscher M. Differing Levels of Acute Hypoxia Do Not Influence Maximal Anaerobic Power Capacity. Wilderness & Environmental Medicine. 2015;26(1):78-82.
23. Meeuwsen T, Hendriksen IJ, Holewijn M. Training-Induced Increases in Sea Level Performance Are Enhanced by Acute Intermittent Hypobaric Hypoxia. European Journal of Applied Physiology. 2001;84(4):283-290.
24. Akılveren E. Futbolda Yüksek iddetli İnterval Antrenman ve Tekrarlı Sprint Antrenmanlarının Aerobik Performans Üzerine Etkisinin İncelenmesi. Akdeniz Üniversitesi Sağlık Bilimleri Enstitüsü: 2018.
25. Gökkurt K. U19 Futbolcularda 8 Haftalık Yüksek Yoğunluklu İnterval Antrenmanın Sürat, Çeviklik ve İvmelenme Üzerine Etkisi. Selçuk Üniversitesi Sağlık Bilimleri Enstitüsü Yüksek Lisans Tezi: 2019.
26. Wong PL, Chaouachi A, Chamari K, Dellal A, Wisloff U. Effect of Preseason Concurrent Muscular Strength and High-İntensity İnterval Training in Professional Soccer Players. The Journal of Strength Conditioning Research. 2010;24:653-60
27. Koşar N. Kin-İşler A. Üniversite öğrencilerinin wingate anaerobik performans profili ve cin-siyet farklılıkları. Spor Bilimleri Dergisi. 2004;15:25-38.
28. Hall D. The Effect of Pilates Based Training on Balance and Gait in an Elderly Population. San Diego State University, Department of Exercise and Nutritional Sciences: 1988.
29. Tsang K, Cargson L, Olson K. Pilot. Crossover Trial of Reiki Versus Rest for Treating Cancer-Related Fatigue, Integrative Cancer Therapies. 2007;6:25-35.
30. Akçınar F. 11-12 Yaş Çocuklarda Pliometrik Antrenmanın Denge ve Futbola Özgü Beceriler Üzerine Etkileri, Sağlık Bilimleri Enstitüsü Doktora Tezi, İnönü Üniversitesi, Malatya: 2014.
31. Harput G, Çolakoğlu FF, Baltacı G. Kadın Voleybol Oyuncularında Pliometrik Eğitimin Dinamik Denge, Sıçrama Mesafesi ve Hamstring Quadriceps Oranına Etkisi, Beden Eğitimi ve Spor Bilimleri Dergisi. 2016;10(3):365-372.
32. Kaplan A, Usgu S, Yakut Y. Adölesan tekvando sporcularında pliometrik eğitimin denge üzerine etkisi, Zeugma Sağlık Araştırmaları Dergisi. 2020;2(3):130-135.

Correspondence
Cemal Berkan Alpay
Ağrı İbrahim Çeçen University, Faculty of Sports Sciences, Ağrı, Turkey
E-mail: berkanalpay@hotmail.com