THE EFFECT OF LUNAR RHYTHMS ON ATHLETIC PERFORMANCE OF A MARATHON RUNNER

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Abstract:
The paper presents results of ex post facto research conducted to determine the effect of lunar rhythms on athletic performance of the marathon runner I. P. The purpose of the research was to analyze the effect of low-frequency biorhythms on athletic performance in a marathon race of Košice International Peace Marathon (KIPM) from 2004 to 2014. The final running times as well as runner's placement were evaluated in relation to lunar rhythms. By clarifying the association between running performance of a marathon runner and lunar rhythms factors underlying training efficiency and athletic performance levels of the studied runner were objectified.

INTRODUCTION

Lunar rhythms are natural cycles occurring every 7 – 14 – 20 – 30 days and falling into the group of low-frequency biological rhythms [3]. These rhythms affect physiological processes of living organisms such as plants and alternate due to the fact that the sun always shines on a different part of the moon [6].

Division of biological rhythms has been studied by a variety of authors [1, 5, 9, 14]. Atmospheric ionization and magnetism of the Earth change depending on the moon phases. Exactly determined rhythms corresponding with synodic month achieve their minimum and maximum level during the new moon and full moon, respectively. Synodic month is the period referring to the achievement of identical phase. Duration of period is 29.53 days with respect to the sun, which represents a reference point and the transition of the entire cycle between two phases of new moon is known as lunation [5, 6]. Researches have shown that depending on its phase the moon affects the magnitude of solar radiation, electromagnetic and ultraviolet radiation, which influences the processes of autonomous functions in all living organisms [6]. With regard to the effect of lunar rhythms and the development of motor abilities throughout the annual training cycle speed-strength athletes achieve peak performance in June and some athletes also in September, endurance athletes achieve their peak performance level as late as September or October [5]. Periodization of the annual training cycle in marathon runners in central European region is affected by climatic conditions and event calendar for the particular year. Annual training cycle of marathon runners in central European region peaks during the second race of the season held in the fall, which is a period with appropriate climatic conditions under which athletes achieve good running endurance performances [11]. As reported by Pisařík, Liška [12] annual training cycle of a marathon runner differs from other running events and physical preparation between marathon races is divided into two separate periods. A marathon run is a typical endurance event determined by resistance to fatigue as a crucial motor ability [2]. Long-term special training preparation of a marathon runner refers to a period lasting from 4 to 6 years. As reported by Kučera, Truksa [7], a marathon runner may achieve peak athletic performance after 6 to 8 years of systematic sports training.

THE MATERIAL AND THE METHODOLOGY.

The aim of the ex post facto research was to determine the effect of lunar rhythms on changes in running performance levels achieved by the marathon runner I. P. (see Table 1) throughout an 11-year period from 2004 to 2014. The marathon runner participated in Košice International Peace Marathon (KIPM) held in October.

Table 1. Basic characteristics of the marathon runner I. P.

Club	Athletic club TJ Obal Servis Košice
Year of birth	1974
Body weight (kg)	59
Body height (cm)	174

Moon phases in particular periods were determined according to lunar calendar (www.moon-phases.net). Lunar rhythms were classified according to Rükl [13] as follows: new moon (1st moon phase) – fist quarter (2nd moon phase) – full moon (3rd moon phase) – last quarter (4th moon phase) and event dates of the KIPM races were assigned particular moon phases (see Table 2). The marathon runner's performances were evaluated intra-individually by casuistic method, where athletic performances in marathon events were objectified according to IAAF Scoring Tables 2011 [4].

Table 2. Moon phases and dates of marathon races (KIPM) 2004-2014

KIPM	Moon phases
3 October 2004	Full moon (3rd phase)
2 October 2005	Last quarter (4th phase)
1 October 2006	First quarter (2nd phase)
7 October 2007	Last quarter (4th phase)
5 October 2008	New moon (1st phase)
4 October 2009	Full moon (3rd phase)
3 October 2010	Last quarter (4th phase)
2 October 2011	New moon (1st phase)
7 October 2012	Full moon (3rd phase)
6 October 2013	New moon (1st phase)
5 October 2014	First quarter (2nd phase)

At the beginning of preparation, training process of the marathon runner I. P. was designed to achieve high performance level in middle-distance running races. The marathon runner has participated in running events since 12 years of age. Progressive development of endurance was crucial in terms of changing the running specialization to long-distance races (see Table 3).

Table 3. Personal bests of the marathon runner I. P. from 2004 to 2014

Event	Time	Year
1,500m	4:07,81	2009
3,000m	8:43,87	2009
5,000m	15:07,60	2009
10,000m	31:10,18	2006
Half-marathon	1:07:45	2007
Marathon	2:21:59	2007

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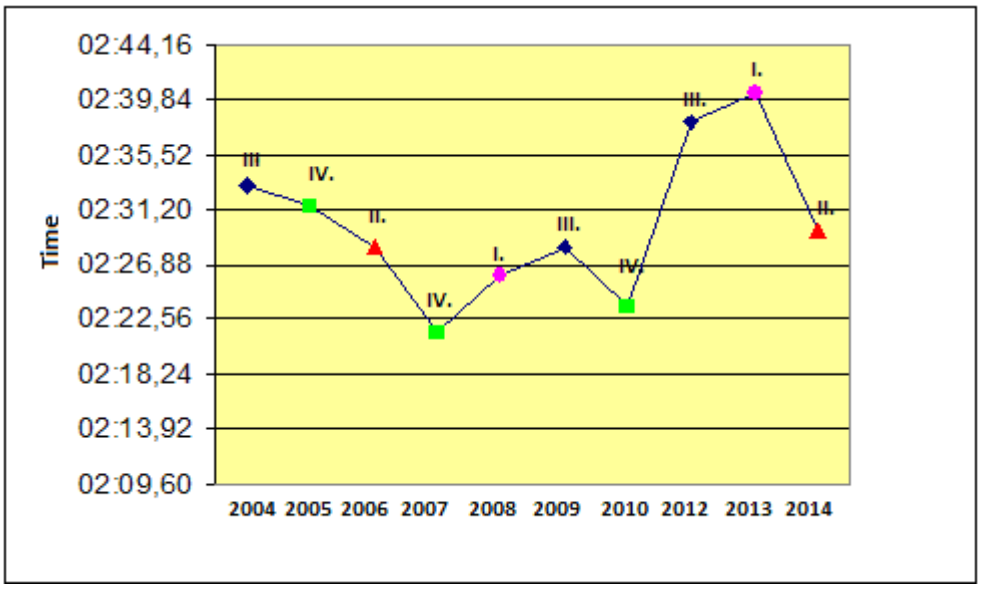
RESULTS AND DISCUSSION

The analysis of times achieved by the marathon runner I. P. in KIPM races held in Košice throughout 2004 to 2014 (see Figure 1) showed that the runner achieved the best time equaling 2:21:59 during the 4th moon phase by placing 6th overall in 2007 and becoming the Slovak marathon champion. According to IAAF Scoring Tables 2011, the performance achieved by I. P. equaled 958 points. The runner's second best time equaling 2:23:55 was recorded during 4th moon phase as well. With this time the runner placed 7th in overall standings of KIPM held in 2010 and his performance equaled 927 points according to the scoring tables. It should be noted that in sports practice coaches should determine intra-individual responses of athletes to the effect of exogenous factors which induce changes in both organism's physiological functions and mental performance [5]. Third best time equaled 2:26:05 and was achieved by I.P. during 1st moon phase and with this time the runner placed 9th overall in the standings of the KICP marathon held in 2008. The performance equaled 892 points. The expected athletic performance compared to his personal best was lower by 4:06 minutes and compared to 2010 the time increased by 3 minutes and 10 seconds. The runner achieved fourth best running time equaling 2:28:35 and 854 points, respectively, during 3rd moon phase and placed 10th overall in the standings of KICP held in 2009. The runner achieved a similar time in 2006, 5th best time, equaling 2:28:25 and 859 points, respectively, during the 2nd moon phase. In this marathon race the runner placed 14th overall. The runner achieved sixth best time equaling 2:29:58 and 833 points, respectively, during the 2nd moon phase and placed 12th overall at the KIPM race held in 2014. The runner achieved 7th best performance equaling 2:31:51 and 804 points, respectively, during 4th moon phase and placed 14th overall in the standings of the KICP held in 2005. The runner improved his personal best from 2004, when he participated in his first marathon race clocking the time of 2:33:13 during 3rd moon phase. During this race the runner placed 12th overall and his performance equaled 784 points. The final time of the runner recorded during his first marathon race is the 8th best time achieved throughout the entire period. The runner achieved 9th best time equaling 2:38:15 and 712 points, respectively, during 3rd moon phase and placed 16th overall in the KIPM race held in 2012. Tenth best time equaled 2:40:42 and was achieved during the 1st moon phase. In this race, the runner placed 21st overall and his performance equaled 678 points, which showed performance decline compared to the previous year as well as the worst running time of all times from 2004 to 2014. During the KIPM held in 2011, the moon was in the 1st quarter and the runner did not finish the race due to health problems and overall discomfort. As reported by Jančoková et al. [6], periodical fluctuation of exogenous conditions induces graded changes in metabolic rate and organisms' behavior. Any change in external environment factors disrupts the activity of the entire organism [10]. As for the effect of particular moon phases on athletic performance of the marathon runner we may conclude the following: athletic performance achieved by the runner always improved significantly during the 4th moon phase over the entire period after his first start in KIPM held in 2004, improvement of personal best in 2007 as well as performance improvement in 2008, 2009 and 2010, respectively. Performance achieved by the runner declined during the 1st moon phase, where in 2008 the runner did not improve his personal best time, did not finish the race in 2011 and achieved the worst time in 2013. During the 2nd moon phase the runner improved his running performance compared to the previous year and achieved personal best time, which signaled improvement in the upcoming year of KIPM. During 3rd moon phase the runner ran his first KIPM race held in 2004 and clocked the time equaling 2:33:13 placing

12th overall. During years to come, the runner's performance declined during 3rd moon phase compared to previous years. It should be noted that not every human organism responds identically to a particular exogenous factor [6]. This may be associated with individual specifics of human organism and also with individual adaptation capacity at a particular time period.



Note: 1st phase - new moon, 2nd phase - last quarter, 3rd phase - full moon, 4th phase - last quarter

Figure 1. Moon phases and times of the marathon runner I. P. at KIPM from 2004 to 2014

CONCLUSIONS

According to research findings and acceptance of a spectrum of factors underlying performance of the marathon runner I. P., following recommendations with regard to the effect of lunar rhythms may be formulated: 4th moon phase is crucial in terms of achieving optimal running performance equaling over 900 points in KIPM races held in 2007 and 2010, respectively. The least appropriate phase is the 1st moon phase, during which the runner achieved the worst time equaling 678 points in KIPM race held in 2013 and did not finish the race in 2011. The research findings highlight the relevance of determining the effects of lunar rhythms on running performance. The effect of lunar rhythms was found to be an intervening factor affecting athletic performance level. Taking into account the effect of particular moon phases allows for effective control of the sports training in order to maximize athletic performance in world-class races. At present, every intervening factor represents an important variable determining the sports preparation of top athletes. Taking the research findings into consideration enables to qualitatively affect the complex preparation of top marathon runners with the aim of improving race performances as well as effectively influencing the quality of recovery and mental comfort during particular stages of athletic training.

REFERENCES

1. Berger, J. (1995) *Biorytmy*. Praha: Paseka.
2. Čillík, I. and Matanin, M. (2004) 'Analýza osemtýždňovej prípravy pred maratónom reprezentanta SR'. *Rozvoj vytrvalostných schopností*. Trnava: KTVŠ STU, pp. 13-18.
3. Halberg, F. (1969) 'Chronobiology', *Annual Review of Physiol*ogy, 31 (1969), pp. 675-725.
4. IAAF Scoring Tables of Athletics 2011. http://www.iaaf.org/about-iaaf/documents/technical#scoring-tables

5. Jančoková, Ľ. (2000) *Biorytmy v športe (s úvodom do chronobiológie)*. Banská Bystrica: UMB FHV KTVŠ.
6. Jančoková, Ľ. et al. (2011) *Chronobiológia a výkonnosť v športe*. Banská Bystrica: UMB FHV KTVŠ.
7. Kučera, V. and Truksa, Z. (2000) *Běhy na střední a dlouhé tratě*. Praha: Olympia.
8. Lunar Calendar. http://www.moon-phases.net/
9. Malachov, G. (2006) *Urinoterapie a biorytmologie*. Bratislava: Arimes.
10. Nemcová, J., Nemec, M. and Paugschová, B. (2013) 'Úroveň športovej výkonnosti vplyvom lunárnych rytmov v biatlone'. *Na podporu projektov VEGA vedecké práce 2013.* Trnava: Univerzita sv. Cyrila a Metoda v Trnave, 2013. pp. 184-194.
11. Nemec, M., Kokinda, M., Turek, M. and Madár, P. (2012) 'Analýza ročného tréningového cyklu maratónskeho bežca'. *Atletika 2012*. *Sborník příspěvků mezinárodní konference*. Brno: MU FSS. 2012, pp. 190-197.
12. Pisařík, M. and Liška., J. (1989) *Běhy na střední a dlouhé tratě*. Praha: ÚV ČSTV.
13. Rükl, A. (1991) *Atlas Měsíce.* Praha: Aventinum.
14. Sedliak, M. (2001) 'Možnosti aplikácie poznatkov chronobiológie pri racionalizácii pohybových režimov'. *Zdravie, zdatnosť, výkonnosť a pohybový režim mládeže a dospelých. Zborník z vedeckého seminára II*. Trenčín: TU KTVŠ, pp. 78-81.