Journal of Molecular and Genetic Medicine

Arazi H, J Mol Genet Med 2016, 10:3
DOI: 10.4172/1747-0862.1000224

Commentary OMICS International

Time of Exercise, As a New Identified Zeitgeber for Modulating the Molecular Clocks in Skeletal Muscle

Hamid Arazi*

Department of Exercise Physiology, Faculty of Sport Sciences, University of Guilan, Rasht, Iran

***Corresponding author:** Hamid Arazi, Associate Professor, Department of Exercise Physiology, Faculty of Sport Sciences, University of Guilan, P.O. Box: 41635-1438, Rasht, Iran. E-mail: hamidarazi@yahoo.com

Received date: July 07, 2016; **Accepted date:** August 30, 2016; **Published date**: September 4, 2016

Description

Since last decades, knowledge regarding health and physical performance has progressively developed and scientists try to find a variety of ways for their maintenance and specially promotion. Therefore, it is necessary to focus on interaction between environmental condition and responses of body tissues such as skeletal muscle. Environment is fundamental determinant for possible changes in our body comprised of temperature, humidity, wind, darkness, lightness, feeding, exercise and etc. that all of them are stressor. In this text we focus in exercise and light, components of environment stress. On the other hand, our body stability requires homeostasis that means maintenance of internal physiologic balance of body. An important part of this vital task is performed by skeletal muscle. Muscles play roles with contractile activity via different actions (concentric, eccentric and isometric). The actions of muscles lead to locomotion that it is necessity of daily life. But, internal stability isn't kept forever and adaptations for better encountering body to environment need to transient disturbance in homeostasis. External stress from out of body Impose shock on related organs and consequently, induce short term imbalance. Physical and mental performance declines below baseline in these conditions. However, body responds to forced stress through opening and promotion of series events in cellular levels to compensate induced turbulence and imbalance. Thus, if these shocks continue regularly, sum of responses will bring adaptations and in result of them, stressed body will develop up to higher level of performance. Collectively, body strengthens and previous stress is tolerated by organs comfortably. One of these environmental stressors is exercise. Everybody needs to do exercise for health or physical performance. Until recent years, health organizations such as American College of Sport Medicine (ACSM) only emphasis on frequency, duration and intensity of exercise for exercise prescription [1] and hasn't been considered time of doing exercise as a probable effective factor. Also, evidence and studies regarding the effect of circadian rhythms and time of exercise on biochemical and metabolic reactions in cells specifically striated muscle fibers are rare.

Now, little evidence demonstrated that circadian rhythms may be important for exercise efficiency. Circadian rhythms are approximate 24 hours biological cycles that their function is to induce readiness the organism for encountering daily environmental changes [2,3]. The most important circadian rhythm is a molecular clock that has activity especially in skeletal muscle. Molecular clock probably acts a key timekeeper mechanism for good interaction with environmental changes at the cellular level.

Circadian time cue is defined as zeitgeber and includes photic and nonphotic [4,5]. Of these, it has been reported that time of exercise or physical activity impact on molecular rhythms in muscle fibers. The molecular clock has components including the positive arms of the core clock (a gene regulatory network composed of transcriptional and translational feedback loops) Clock (Circadian locomotor output control kaput) and Bmall1 (Brain muscle arnt-like 1). Bmall1 protein is expressed in a circadian pattern in the suprachiasmatic nucleus (SCN) and peripheral tissues [6,7]. Clock protein levels oscillate only in some peripheral tissues [8]. The Cryptochrome (Cry1 and Cry2) and Period (Per1, Per2 and Per3) proteins are the negative arm of core molecular clock by producing multimers that suppress Clock-Bmall1 transcriptional activity on translocation to the nucleus [9].

As previously mentioned, time of exercise addition to activity entity, may be along with more benefits for performance and health achievements in shorter duration rather than exercise regardless time of conduction. Therefore, the timing of exercise could serve as a cue is relatively new. Schroeder et al. found that scheduled exercise functioned to enhance the stability of activity rhythms [4]. Most studies with entitled exercise and circadian rhythms shifting focused on aerobic exercise patterns and there is very little research about resistance exercise. For Example, Zambon et al. reported that single bout of 60 contraction changed molecular clock gene expression in skeletal muscle of human [10]. Also, most studies investigated exercise in mice. Thus, generalizing achieved result of them to human is difficult. Considering importance of skeletal muscle in human body physiology, and effect of time of exercise on molecular clocks it seems that exercise specially time of exercise as a nonphotic time cue will have great applications in scope of health and physical performance (muscular strength and endurance) for athletes. Further studies are necessary for precise conclusion in this context.

References

1. Thompson WR (2015) Now trending: Worldwide survey of fitness trends for 2016: 10th Anniversary Edition. ACSMs Health Fit J 19: 9-18.
2. Idda ML, Bertolucci C, Vallone D, Gothilf Y, Sa´nchez-Va´zquez FJ, et al. (2012) Circadian clocks: Lessons from fish. Prog Brain Res 41-57.
3. Loudon ASI (2012) Circadian biology: A 2.5 billion year old clock. Curr Biol 22: R570-R571.
4. Schroeder AM, Truong D, Loh DH, Jordan MC, Roos KP, et al. (2012) Voluntary scheduled exercise alters diurnal rhythms of behavior, physiology and gene expression in wild-type and vasoactive intestinal peptide-deficient mice. J Physiol 590: 6213-6226.
5. Wolff G, Esser KA (2012) Scheduled exercise phase shifts the circadian clock in skeletal muscle. Med Sci Sports Exerc 44: 1663-1670.
6. Damiola F, Le Minh N, Preitner N, Kornmann B, Fleury-Olela F, et al. (2000) Restricted feeding uncouples circadian oscillators in peripheral tissues from the central pacemaker in the suprachiasmatic nucleus. Genes Dev 14: 2950-2961.

7. Lee Y, Chen R, Lee H, Lee C (2011) Stoichiometric relationship among clock proteins determines robustness of circadian rhythms. J Biol Chem 286: 7033-7042.
8. Miyazaki M, Schroder E, Edelmann SE, Hughes ME, Kornacker K, et al. (2011) Age-associated disruption of molecular clock expression in skeletal muscle of the spontaneously hypertensive rat. PLoS ONE 6: e27168.
9. Schroder EA, Esser KA (2013) Circadian rhythms, skeletal muscle molecular clocks, and exercise. Exerc Sport Sci Rev 41: 224-229.
10. Zambon A, McDearmon E, Salomonis N, Vranizan KM, Johansen KL, et al. (2003) Time- and exercise-dependent gene regulation in human skeletal muscle. Genome Biol 4: R61.