JPJO 4 (1) (2019) 27-31

Jurnal Pendidikan Jasmani dan Olahraga

http://ejournal.upi.edu/index.php/penjas/index

Vo2max Measurement Using Bleep Test with Infrared Sensor

Agus Rusdiana[1], Iman Imanudin[1], Angga Muhamad Syahid[2], Ricky Wibowo[3]

[1]Prodi Ilmu Keolahragaan, Fakultas Pendidikan Olahraga dan Kesehatan, Universitas Pendidikan Indonesia.

[2]Prodi Kepelatihan Olahraga, Fakultas Pendidikan Olahraga dan Kesehatan, Universitas Pendidikan Indonesia.

[3]Prodi PGSD Penjas, Fakultas Pendidikan Olahraga dan Kesehatan, Universitas Pendidikan Indonesia.

Info Artikel

Sejarah Artikel :

Diterima Agustus 2018

Disetujui Agustus 2018

Dipublikasikan September 2018

Keywords :

Maximal aerobic capacity, Bleep test, Sensor Infrared dan Software Motion Analysis system.

Abstrak

Penelitian ini bertujuan untuk mengembangkan alat ukur Maximal aerobic capacity melalui bleep test berbasis digital dengan menggunakan sensor infrared dan software motion analysis system supaya mendapatkan hasil penilaian yang lebih tepat, akurat dan efesiensi pengerjaan dalam melakukan tes. Metode penelitian yang digunakan oleh peneliti adalah metode R&D (research and Development), bekerjasama dengan tim pakar atau ahli dalam berbagai bidang tertentu supaya dalam pengembangan prototype sederhana ini yang dapat menciptakan suatu produk yang dapat divalidasi sebelum diproduksi secara massal. Hasil dari penelitian ini akan menciptakan suatu alat ukur berbasis digital yang sudah dilakukan uji validitasnya dengan hasil dinyatakan VALID. Dengan adanya penelitian yang mengembangkan suatu produk dapat menghindari kesalahan atau Human error dalam pengerjaan tes ,mendapatkan hasil yang akurat di bandingkan tes secara manual dan pengerjaan lebih efesien.

Abstract

The purpose of this study was to develop a measuring device to measure maximal aerobic capacity by using digital bleep test with infrared sensor and motion analysis system software to obtain a more accurate, precise, and efficient assessment result in conducting the test. The method used in the study was R & D (Research and Development) method. This research was conducted in collaboration with a team of experts of various specific fields so that the development of this simple prototype could create a validated product before mass production is conducted. The result of this study will create a digital-based measuring instrument that has been valid through validity test. Conducting a study that develops a product could prevent error and human error during the test. Therefore, a more efficient process and a more accurate result can be obtained compared to manual testing.

✉ Alamat korespondensi : Jl. Dr. Setiabudhi No. 229. Bandung, Indonesia

E-mail : Agus.rusdiana@upi.edu

ISSN 2580-071X *(online)*

ISSN 2085-6180 *(print)*

DOI : 10.17509/jpjo.v3i2.12640

INTRODUCTION

Maximal aerobic capacity is commonly known as a capacity determining a person's maximum indicator in consuming oxigent (Sulaiman et al., 2011). Maximal aerobic capacity can be defined as the ability of a human body in maximizing pulmonary, cardiovascular, and muscle systems to absorb, distribute, and use the oxigent (O2) (Enry & Ilcox, 2011 ; Bruno, Smirmaul, Bertucci, & Inaian, 2013). Maximal aerobic capacity has a critical role to support an athlete in reaching achievement in a game or in a personal sport. Maximal aerobic capacity is a basic physical fitness measurement for an athlete since the score of maximal aerobic capacity is highly related to an athlete's ability that contributes to their aerobic system and health support in young age (Longo, Aquilino, Cardey, & Lentini, 2016 ; Legazarrese, Munguía-izquierdo, Nuviala, & Serveto-galindo, 2007; Mahar, Guerieri, Hanna, & Kemble, 2011).

An athlete's maximal aerobic capacity can be measured through conducting a maximal aerobic capacity measurement by using bleep test. This measurement technique is a popular aerobic measurement that has been commonly used by coaches to measure their athletes' abilities (Paradisis, Zacharogiannis, Mandila, & Smirtiotou, 2014; Gumelar et al., 2017). During conducting the bleep test, the athlete and the coach should have known the procedure of the test that includes: the subject or the athlete shuttles between two lines that have been marked by cones with 20 meter distance, the speed of running begins from 8,5 km/h-1 and increases 0,5 km/h-1 every minute, the speed of the subject of the athlete is arranged by the sound "bleep" of the audio recorder and the subject is expected to reach the cones when do the shuttle so that they achieve the maximum speed (Enry & Ilcox, 2011; Article, 2005(Leger, Mercier, Gadoury, & Lambert, n.d.).

Nowadays, the role of science and technology on sport is crucial since the use of digital or sensor based devices to conduct a measurement or to analyze a movement has been widely used (Haryono & Pribadi, 2012). The human movement analysis is important to diagnose various movements involved in sport (Alahakone, 2009). A scientific approach of sport is started with a measurement that results in a training with a more efficient movement (Ueda, Negoro, Kurihara, & Watanabe, 2013). Therefore, the development of a sensor-based device with bleep test technique and motion analysis system software to measure maximal aerobic capacity will be beneficial for the coach to do analysis in conducting a measurement test (Radakovic et al., n.d.). The sensor in this research will become a hardware, a supporting software device. There are a lot of sensors that have been created including infrared sensor that could give an accurate data that reduce the noise and minimize errors (Engineering & Bahru, 2013), an infrared thermography sensor to detect body temperature (Dai et al., 2015), and inertial sensor to detect walking movement (Lee, Mellifont, & Burkett, 2010).

METHOD

The method used in the study was Research and Development (R&D) method by developing a prototype or a digital based device. In this research, the process of the device development was in collaboration with a team of experts to develop a measuring device product, a bleep test with infrared sensor and motion system software. The sampling technique of the study was a purposive sampling since the samples should meet certain requirements and considerations. In this study, the researchers chose ten students from the Faculty of Physical Educatin, Sport, and Health, Universitas Pendidikan Indonesia, who were active in football club.

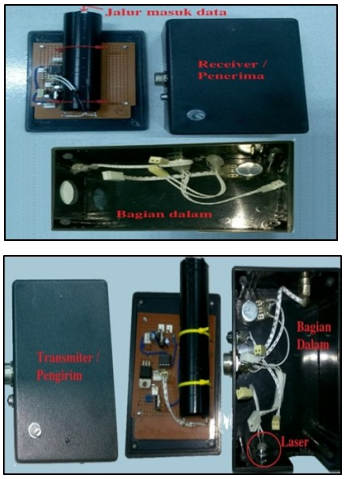
The stages adapted by the researchers in the study include seven stages namely: 1) potentials and problems 2) data collection 3) product design 4) validation and design correction 5) test of the product 6) data analysis 7) arranging report. In this study, the instrument used by the researchers to test its validity and reliability was by correlating the result of manual testing and the result of digital with sensor testing. The correlation test employed product moment correlation formula or bivariate correlation from carll Pearson since this testing involved two tests or two variables.

RESULT AND DISCUSSION

The design of the maximal aerobic capacity product with sensor-based bleep test technique and motion software resulted in a product or a digital-based prototype, including:

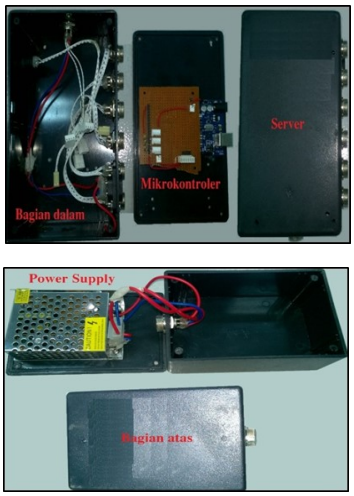
DOI : 10.17509/jpjo.v3i2.12640

a. The Circuit and Sensor Product for Bleep Test (Transmitter dan Receiver) (picture 1).



Picture 1. The Transmitter and Receiver Circuit

b. The Circuit and Sensor Supporting Product (Microcontroller and Power Supply) (picture 2).



Picture 2. The Circuit of Microcontroller and Power Supply

The working system of the device includes 1) Connecting the wire to the device that will be used in the bleep tes for 20 meter distance; 2) Assuring that all of the devices are connected to the power supply so that the sensor can be turned on and ready to use; 3) Adjusting the light setting before conducting the test; 4) Making sure that the samples understand the rule in performing sensor-based bleep test; 5) Turning on the software to support the sensor-based bleep test.

Picture 3. The Trials of Sensor-based Bleep Test and Motion Software

The trials of maximal aerobic capacity device development by using sensor-based bleep test technique and motion analysis system software involved ten UPI students who were active in football club as the sample. The purpose of the trial was to find out the effectiveness level of the test and to gain a more accurate result. After conducting the trial on the sample, the score of the maximal aerobic capacity from the manual bleep test and prototype sensor test and motion analysis system software did not show significant differences. Moreover, the researchers also wanted to discover the weakness of the developed devices.

The next stage was the data analysis by using statistical product and service solutios (SPSS) to conduct comparison test whether the validity test of the prototype and the manual test are different. The description of the test result with ten samples on the prototype and manual test is presented in Table 1.

Tabel 1. Descriptive tetst result Protoype dan Bleep Tes

Test	Mean	Sd	P*
Bleep Digital (n=10)	50.35	±3.205	0.643*
Bleep test manual (n=10)	51.52	±3.165	0.646*

The Table 1 presents that the data were normal and homogenous. Therefore, the researchers conducted

DOI : 10.17509/jpjo.v3i2.12640

comparison test by comparing data from the same group in the maximal aerobic capacity test by using prototype and manual test (beep test). This comparison was to find out whether there are differences between the two data. The result of the comparison test can be seen in the Table 2.

Table 2. Comparison Test of The Manual Bleep Test and Digital-based Bleep test

	Sig
The Manual Bleep Test and Digital-based Bleep test	0,422*

*sig. 0.01

The data in Table 2 conclude that there is no significant difference from manual bleep test and digital-based bleep test. Moreover, the researchers wanted to discover the level of test validity by correlating the result of the trials between the manual and the digital-based prototype with sensor. Therefore, the data analysis with Pearson correlation validity and realibility test was conducted (table 3):

Tabel 3. Person Correlation Validity and Realibility Test

Tes	Sig
Prototype	1*
Bleep test Manual	0.999*

*sig. 0.01

After analyzing the result of maximal aerobic capacity test by using Pearson Correlation Test, the value of the prototype test was 1 and the value of the manual test was 0,999. Both of them gained higher value than the r table 0.05, which is 0.549. It concludes that the data were valid. If the significance value of r Alpha was 1,000, it should be consulted to r coefficient interpretation. Therefore, the conclusion of the r Alpha 1,000 shows a very high reliability according to the r coefficient interpretation.

CONCLUSION

The development of maximal aerobic capacity device prototype by using bleep test with sensor and motion analysis system software is successfully designed with a simple prototype. According to the result of analysis, it concludes that maximal aerobic capacity prototype with sensor and motion software have a very high validity and reliability value. Therefore, by using this system, an athlete can obtain a more accurate test result that could prevent human error during the process of the test. Additionally, the process of the test can be conducted in a more efficient way.

REFERENCES

Alahakone, A. U. (2009). 2009 International Conference of Soft Computing and Pattern Recognition A Real Time Vibrotactile Biofeedback System for Improving Lower Extremity Kinematic Motion During Sports Training, 616–621. http://doi.org/10.1109/SoCPaR.2009.120

Bruno, P. . S., Bertucci, D. R., & Inaian, P. (2013). Is the VO 2 max that we measure really maximal ?, 4 (August), 1–5. http://doi.org/10.3389/fphys.2013.00203

Cooper, S.-M., Baker, J. S., Tong, R. J., Roberts, E., & Hanford, M. (2005). The repeatability and criterion related validity of the 20 m multistage fitness test as a predictor of maximal oxygen uptake in active young men. Br J Sport Med, (ii), 1–8. http://doi.org/10.1136/bjsm.2004.013078

Dai, F., Cogi, N. H., Ugo, E., Heinzl, L., Costa, E. D., Canali, E., & Minero, M. (2015). Validation of a fear test in sport horses using infrared thermography. Journal of Veterinary Behavior: Clinical Applications and Research, 10(2), 128–136. http://doi.org/10.1016/j.jveb.2014.12.001

Engineering, M., & Bahru, J. (2013). Application of Infrared Sensor for Shape Detection, 145–147.

Haryono, S., & Pribadi, F. S. (2012). Pengembangan Jump Power Meter Sebagai Alat Pengukur Power Tungkai, 2.

Lee, J. B., Mellifont, R. B., & Burkett, B. J. (2010). The use of a single inertial sensor to identify stride , step , and stance durations of running gait. Journal of Science and Medicine in Sport, 13(2), 270–273. http://doi.org/10.1016/j.jsams.2009.01.005

Legaz-arrese, A., Munguía-izquierdo, D., Nuviala, A. N., & Serveto-galindo, O. (2007). Average VO 2 max as a function of running performances on different distances VO 2 max moyen en fonction de la performance de course sur différentes distances, 22, 43–49. http://doi.org/10.1016/j.scispo.2006.01.008

Leger, L. A., Mercier, D., Gadoury, C., & Lambert, J. (n.d.). run test for aerobic fitness The multistage 20 metre shuttle run test for aerobic fitness. Journal of Sport Sciences, (May 2013), 37–41.

Longo, A. F., Aquilino, G. D., Cardey, M. L., & Lentini, N. A. (2016). ˙ O 2 max assessment in athletes : A thorough method comparison study between Yo-Yo test and direct measurement . Apunts Medicina de l'Esport, (xx), 1–6. http://doi.org/10.1016/j.apunts.2016.07.001

Mahar, M. T., Guerieri, A. M., Hanna, M. S., & Kemble, C. D. (2011). Estimation of aerobic fitness from

20-m multistage shuttle run test performance. American Journal of Preventive Medicine, 41(4 SUPPL. 2). http://doi.org/10.1016/j.amepre.2011.07.008

Paradisis, G. P., Zacharogiannis, E., Mandila, D., & Smirtiotou, A. (2014). Multi-Stage 20-m Shuttle Run Fitness Test , Maximal Oxygen Uptake and Velocity at Maximal Oxygen Uptake, 41, 81–87. http://doi.org/10.2478/hukin-2014-0035

Penry, J. T., Wilcox, A. R., & Yun, J. (2011). Validity and Realibility Analysis of Cooper's 12-Minute Run and The Multistage Shuttle Run In Healthy Adults. Journal of Strength and Conditioning Research, 25 (3), 597–605.

Radakovic, R., Dopsaj, M., R., V., Leontijevic, B., N., M., & Filipovic, N. (n.d.). The reliability of motion analysis of elite soccer players during match measured by the Tracking Motion software system.

Sulaiman, N., Akmal, M., Nasir, M., Adnan, R., Misdan, M., & Ahmad, H. (2011). Criterion Validity of Yoyo Intermittent Endurance Test in Estimating Maximal Oxygen Consumption among Malaysian Elite Football Players . IEEE Colloquium on Humanities, Science and Engineering Research, (Chuser), 281–284.

Ueda, M., Negoro, H., Kurihara, Y., & Watanabe, K. (2013). Measurement of Angular Motion in Golf Swing by a Local Sensor at the Grip End of a Golf Club, 43(4), 398–404. Wiklund, P. (2016). The role of physical activity and exercise in obesity and weight management: time for critical appraisal. Journal of Sport and Health Science, 1–8. https://doi.org/10.1016/j.jshs.2016.04.001

World Health Organization. (2015). Global status report on noncommunicable diseases 2014.

World Health Organization. GPAQ Intrument and Analysis Guide version 2. Retrived from www.who.int/ncds/surveillance/steps/GPAQ/en/

World Health Organization. (2018). Physical activity. WHO. Retrieved from http://www.who.int/mediacentre/factsheets/fs385/en/

Zhu, S., Wang, Z., Heshka, S., Heo, M., Faith, M. S., & Heymsfield, S. B. (2018). Waist circumference and obesity-associated risk factors among whites in the third National Health and Nutrition Examination Survey : clinical action thresholds 1 – 3, (July).

DOI : 10.17509/jpjo.v3i2.12640