Available online at http://www.journalijdr.com

ISSN: 2230-9926

International Journal of Development Research
Vol. 08, Issue, 05, pp.20592-20595, May, 2018

ORIGINAL RESEARCH ARTICLE OPEN ACCESS

COMPARATIVE ELECTROMIOGRAPHIC ANALYSIS OF CONVENSIONAL ABDOMINAL EXERCISE WITH GYMNASTIC BALL

***João Roberto Kelencz and Carlos Alberto Kelencz**

Centro Universitário Ítalo Brasileiro – São Paulo- Brasil

ARTICLE INFO

Article History:
Received 22nd February, 2018
Received in revised form
06th March, 2018
Accepted 22nd April, 2018
Published online 31st May, 2018

Key Words:
Abdominal exercises,
Electromyography,
Fitness Ball.

ABSTRACT

The aim of this study is to compare abdominal exercises using conventional gymnastic and the abdominal ball. The intensity of each abdominal exercise is analyzed through electromyography. The muscles analyzed were: rectus abdominis and external obliquus. One of the factors that help mainten a good posture is the stabilizing of the trunk muscles, known as "CORE". They are muscles of the abdominal region that work together, to form a support for the spine (abdominal transverse, external oblique and internal oblique, recto-abdominal and multifidi), when they fail in their function, the spine becomes vulnerable and susceptible to injury. Twenty volunteers took part in this study, 10 men and 10 women, with an average age of 25, all physically active for at least three months. They performed series of each of the exercises for a 15s period. In conventional exercises we observed a high electrical activity (RMS) of the right and left abdominal muscles for both groups, which corroborates the results of a large number of authors who stress that these abdominal exercises are very efficient in recruitment of the rectus muscle. With the abdominal exercise on the ball, the results also demonstrated a good activity of the rectus abdominis, although with a lower electromyographic signal than with the conventional one, but the oblique muscles showed superior abdominal activity. These results led to the conclusion that when the focus is to work the abdominal rectus muscle with more intensity the conventional exercise is more indicated and when the intention is to focus on more intensity on the obliques the abdominal exercise with ball seems to be the mostindicated.

Citation: João Roberto Kelencz and Carlos Alberto Kelencz, 2018. "Comparative electromiographic analysis of convensional abdominal exercise with gymnastic ball", *International Journal of Development Research*, 8, (05), 20592-20595.

INTRODUCTION

The advent of new technologies, the evolution of transportation and devices that reduce the natural physical efforts of human beings, has caused a phenomenon known as Hypokinesia, which added to an exaggerated work load, and a lack of free time raises the level of stress. This leads to the idea of prevention and rehabilitation. Taking into account the problems and complaints that the lack of physical activity provokes, among which one of the greatest is pain in the lower back originating from the lack of physical activity, as well as a lack of adequate orientation by professionals of physical education and self-consciousness of the body during the execution of everyday movements and exercises with loads higher than the possibilities of theindividual. One of the biggest health problems is related to lower back pain.

Corresponding author: **João Roberto Kelencz,**
Centro Universitário Ítalo Brasileiro – São Paulo- Brasil.

The causes of lower back pain are usually related to lack of activity of the abdominal muscles, sedentary lifestyle and a lack of orientation and self-awareness of individuals when lifting heavy loads. The main function of the abdominal wall muscles is to provide stability to the spine. (MANSO, J. M. G GRIGOLETTO, M. E. S. 2008). According to Vaz et al. (1997), the work of the abdominal muscles is extremely important for humans because these muscles tend to reduce the compression of the intervertebral discs and help improve respiratory mechanics and pelvic movements, thereby helping reduce back pain. In this sense, the present study aims to analyze through electromyography the two most commonly used abdominal exercises to strengthen the rectus abdominis and external obliquus muscles, which are: abdominal abdominal and conventional gymnasticball.

MATERIALS AND METHODS

Participants: Twenty volunteers took part in this study (10 men and 10 women) with an average age of 25, all physically

active for at least three months. They performed traditional abdominal exercises (Fig.1) and abdominal exercises on the Swiss ball (Fig.2), both exercises were performed for 15seconds.

Figure 1.

Figure 2.

The test was done individually and according to the availability of the participants. Before starting the exercise program the purpose of the research was explained to the participants and a Consent and Informed form was signed. The muscles analyzed through surface electromyography were: the abdominal rectus and external obliquus, since they help in the stabilization and control of the spine and posture of the trunk (Fig. 3). In order to capture the signals, Heat Bret® surface electrodes and an eight-channel (EMG System do Brasil Ltda.®) electronic signal acquisition module (Electromiograph), consisting of a signal conditioning with pass- bands between 20 and 500 HZ, an amplification gain of 1000HZ and a common mode overdrive mode greater than 120 dB (Figure 3) were used. Data were acquired using a 12-bit analog-to-digital board with a sampling rate of 2000 HZ per channel. AdData software was used for data acquisition. In order to reduce possible interferences in the induction of the stimulus in the region of the muscle studied, prior to the placement of the electrodes, tricotomy (in the case of male volunteers) and 70% alcohol cleansing were performed. For the fixation of the electrodes a conductive gel with adhesive tape was used in the line of the middle portion of the central portion of the muscle, with the detection surface perpendicular to the fibers of themuscle (Solomonow, 1995; Wilms, 1987). In all procedures, the acquisition and analysis of the electromyographic signals followed the recommendations of the International Society of Electromyography and Electrokinesiology (ISEK) (WILLIAMS, 1987). The positioning of the electrodes adopted was the same as the procedure described by Delagi et al (2005). To define the position of the electrodes used to monitor the external oblique muscle, we initially identified the highest point of the iliac crest, as well as the anterior superior iliac spine. In this line, the electrode was placed towards the head of the iliac crest until the aponeurosis was identified (Fig. 4).

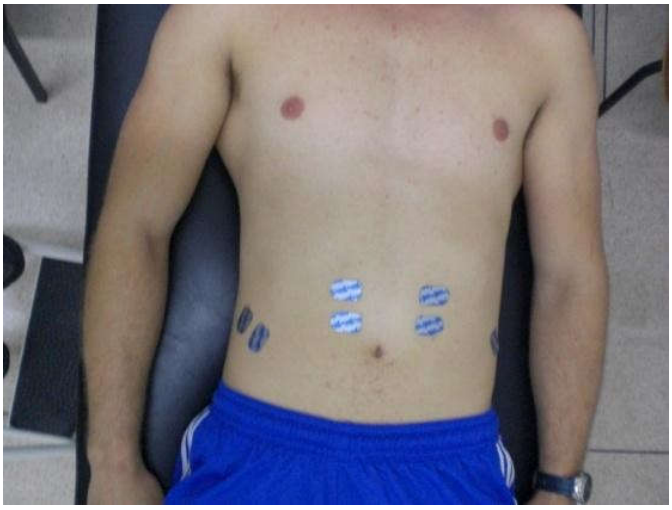


Figure 3.

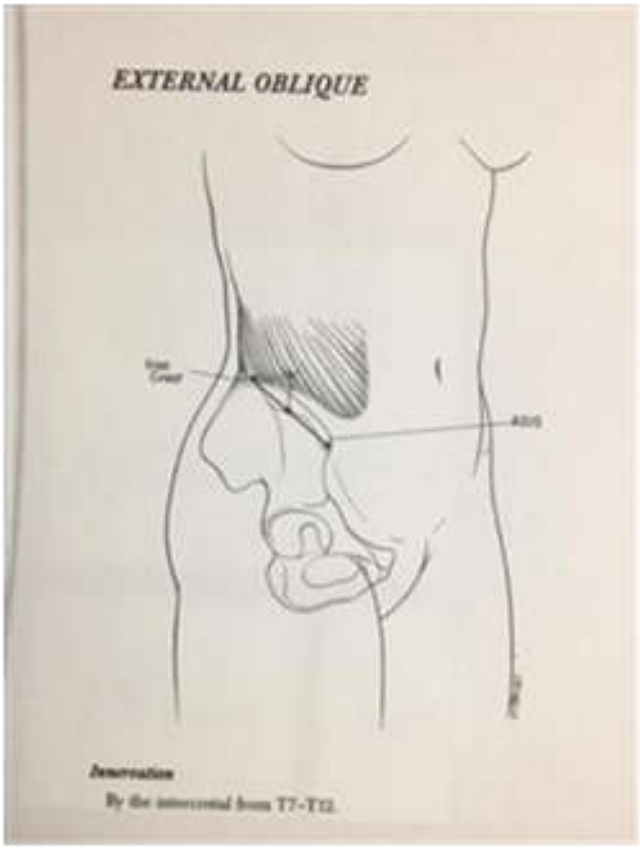


Figure 4. Positioning of the electrode on the external oblique muscle is on T 7 – T12

For the rectus abdominis muscle, the electrode was placed laterally on the abdominal midline (the umbilical portion in T10). (Fig 5) After the collection, the electromyographic signals were analyzed using MATLAB software and BIOMEC 4000.

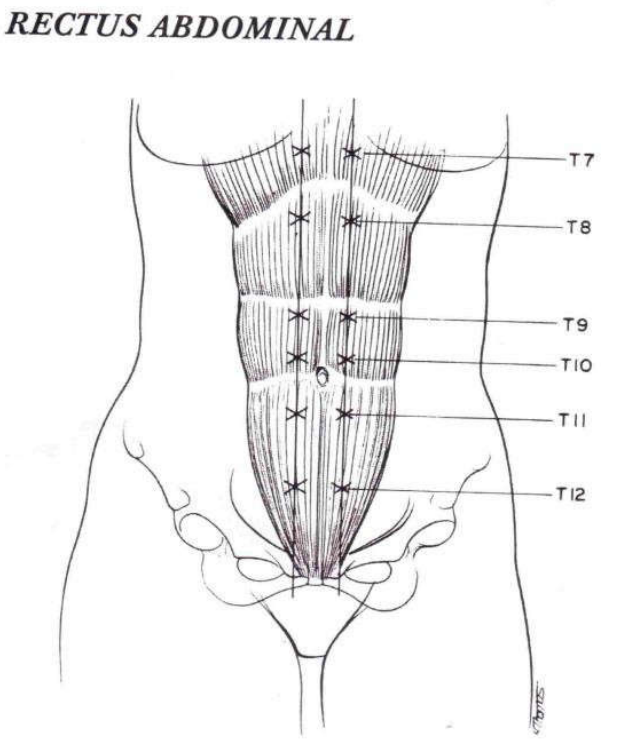
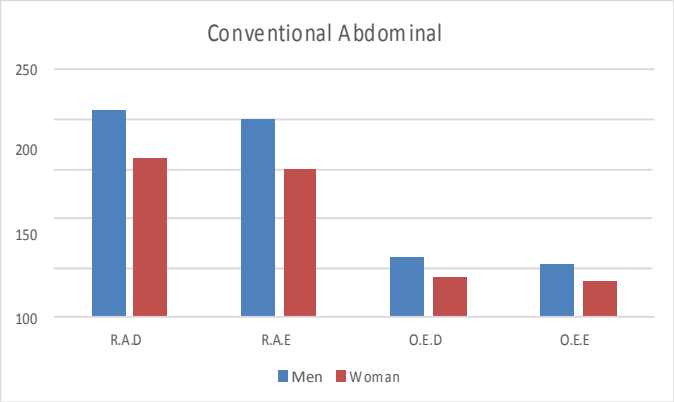


Figure 5. Positioning of the electrode on the rectus abdominis muscle is on T 10

After processing the signals they were statistically analyzed and compared to the results.

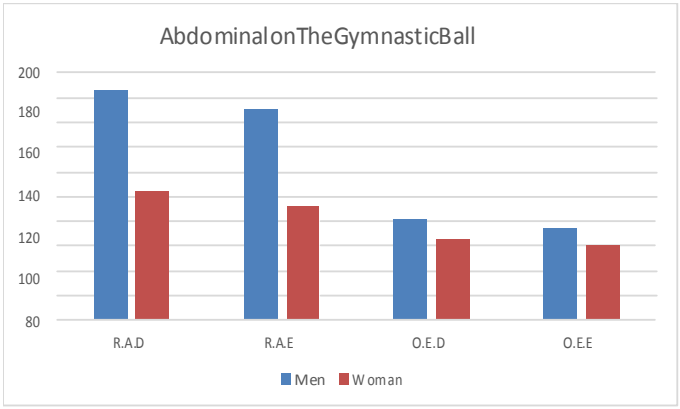
RESULTS

The following results present the mean values expressed by the mean square root (RMS) of all muscles tested during the exercises. In conventional abdominal exercise (Graph. 1) we observed an intense electrical activity of all muscles tested in both sexes, and the rectus abdominis muscle was the most active.



Graphic 1. Comparison of results of electromyographic collections of muscles RAD, RAE, RE and LE during Conventional Abdominal exercise

The abdominal exercise gymnastic ball (Graph 2) presented results very similar to those recorded in the conventional abdominal, and the external oblique muscle was the most active.



Graphic 2. Comparison of the results of the electromyographic collections of the RAD, RAE, OD and OE muscles during Abdominal exercise in the gymnastic ball

DISCUSSION

In the conventional abdominal exercise we observed a high electrical activity (RMS) of the RAD and RAE muscles, for the male group an average of 210 RMS and for the female 160 RMS, which corroborates the results of a large number of authors who point out that this abdominal exercise is very efficient in recruiting the rectus abdominis muscle. (VAZ; GUIMARÃES; CAMPOS, 1991; VERA- GARCIA; GRENIER; MCGILL, 2000; STERNLICHT; RUGG, 2003). Regarding the external oblique muscle, the male mean was approximately 60 RMS, and the female RMS approximately 40 RMS. Even with less electrical activity than the rectus abdominis, we can consider that the external oblique has an important participation in the execution of this exercise (BALDISSERA,2007). In the abdominal exercise with the gymnastic ball, there was a small reduction of electrical activity compared to the conventional abdominal exercise, the rectus abdominus muscle registered 185 RMS in the male group, whereas the female group was 105 RMS. Regarding the obliquus external muscle the mean was 82 for the male group and 65 for the female. These muscles presented greater activation than the conventional abdominal muscles. This may have occurred due to the fact that this exercise is performed on an unstable surface (ball) which would force the oblique togreater activation to remain stable and achieve more balance during the execution of the exercise (ESCAMILA, 2010; STERNLICHT,2007; BERNARDINO JÚNIOR,2007; CRAIG, 2006).

Conclusion

This study concluded that the abdominal exercises studied are effective for abdominal strengthening work out, however we observe that there is a significant variation regarding the intensity and stimulation of the muscles. For the rectum of the abdomen to work more intensely, the most effective exercise is the conventional abdominal. Whereas for the external oblique the exercise performed on the gym ball is the most effective. Therefore, we can say that the gymnastic ball can be used to diversify abdominal exercises and training, since exercise the ball requires greater control during the execution of the movements due to its unstable surface.

REFERENCES

Abdominal muscle response during curl-ups on both stable and labile surfaces. *Physical Therapy*, v.80, n.6, p. 564-569, 2000.

Baldissera, V. e colaboradores. Comparação dos exercícios abdominais convencionais através da eletromiografia no domínio do tempo. Anais 25th International Symposium on Biomechanics in Sports. Ouro Preto, p. 660-662. 2007. 2- Bird, M. e colaboradores Electromyographic comparison of the ab-slide and crunch exercises. Journal of strength and conditioning research. Vol. 20, Núm. 2, 2006.

BERNARDINO JÚNIOR, R. et al. Análise eletromiográfica da atividade elétrica dos músculos reto do abdome e reto femoral em exercícios abdominais com e sem bolade ginástica.

DELAGI, E. F. et al. Anatomic Guide for the Eletromyographer. Springfield, Illinois, USA: Charles C. Thomas Publisher,2005.

Escamilla, R.F. e colaboradores. Core muscle activation during swiss ball and tradicional abdominal exercises. Journal of orthopaedic & sports physical therapy. Vol. 40, Núm. 5,2010.

Exercícios Abdominais: Um Estudo Biomecânico e Eletromiográfico. Revista Brasileira de Ciências e Movimento, v.5, n.4, p.18-40, 1991.

MANSO, J.M.G.; GRIGOLETTO, M.E.S. Treinamentodos músculos abdominais e lombares. Editora Phorte. 2008.

SOLOMONOW, M. A. Pratical Guide to Eletromyography. International Society of Biomechanics congress, XV,1995.

Sternlicht, E. e colaboradores. Electromyographic comparison of a stability ball crunch with a traditional crunch. Journal of strnght and conditioning research. Vol. 21, Núm. 2,2007.

STERNLICHT, E.; RUGG, S. Electromyographic analysis of abdominal muscles activity using portable abdominal exercises devices and a traditional crunch. J. Strength Cond. Res., v.17, n.3, p.463-468, Aug.2003.

VAZ, M.A.; GUIMARÃES A.C.S.; CAMPOS, M.I. Análisede

VAZ, MA. et al.(1997). Comparação da atividade elétrica do músculo reto abdominal e oblíquo externo em exercícios abdominais com e sem utilização de aparelhos. *Anais Congresso Brasileiro de Biomecânica*, vol 7: 441-446,1997.

VERA-GARCIA, F.J.; GRENIER, S.G.; MCGILL,S.M..

WILLIAMS, K. R. Standardizing biomechanical testing in sport. Dainty Da, Norman, Rw. Res. Quart. Exercise Sport, v. 58, p. 286- 287,1987.

****