# PERBEDAAN AKTIVITAS OTOT TUBUH BAGIAN ATAS SISI DOMINAN POSISI BERDIRI DAN DUDUK SAAT MELAKUKAN PUKULAN DALAM *VIRTUAL REALITY EXERGAME*

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**Abstrak**

**Objektif:** Aktivitas fisik dikaitkan dengan berbagai manfaat kesehatan, sayangnya, individu disabilitas dapat mengalami masalah kesehatan dan halangan yang lebih besar terhadap partisipasi aktivitas fisik dibanding populasi umum. *Exergame* (EXG) tinju berbasis *virtual reality* (VR) dapat menjadi opsi alternatif dalam usaha meningkatkan aktivitas fisik karena menyenangkan, relatif mudah diakses dan biaya terjangkau. Pukulan dalam tinju membutuhkan gerakan yang kompleks, yang mana tubuh bagian bawah merupakan kontributor pukulan efektif. menyeluruh mengenai aktivitas otot yang terlibat penting untuk menilai potensi manfaat VR EXG. Studi pengukuran berulang *pre-posttest* ini bertujuan untuk mengevaluasi perbedaan aktivitas otot tubuh bagian atas sisi dominan posisi berdiri dan duduk saat melakukan pukulan dalam VR EXG dengan tujuan penggunaan pada individu dengan masalah tubuh bagian bawah.

**Metode:** Lima belas pria dewasa sehat (usia 31,87±3,14, indeks massa tubuh 23,77±2,47 $kg.m^{-2}$) menjalani pemeriksaan *surface electromyography* pada empat otot tubuh bagian atas sisi dominan (*upper* trapezius, deltoid anterior, bisep, trisep) pada saat melakukan pukulan *straight*, *hook* dan *uppercut* selama bermain VR EXG "Fitness Boxing" Nintendo Switch™. Pemeriksaan dilakukan dalam dua posisi bermain, yaitu posisi berdiri dan duduk.

**Hasil:** Tidak ada perbedaan bermakna nilai %MVIC otot upper trapezius (UT), deltoid anterior (DA), bisep (B) dan trisep (T) sisi dominan saat subjek melakukan pukulan *straight*, *hook* dan *uppercut* (nilai $p > 0,05$), kecuali pada variabel %MVIC otot *upper* trapezius saat melakukan pukulan *uppercut* posisi berdiri dibandingkan posisi duduk (nilai $p = 0,041$).

**Kesimpulan:** VR EXG "Fitness Boxing" Nintendo Switch™ dapat dilakukan pada posisi berdiri maupun duduk, untuk mendapatkan efek serupa pada otot tubuh bagian atas.

**Kata Kunci:** aktivitas otot, elektromiografi, *exergame*, nintendo switch, posisi bermain, tinju, *virtual reality*

# UPPER LIMB MUSCLES ACTIVITY DIFFERENCES OF THE DOMINANT SIDE ON STANDING AND SITTING POSITION WHEN DELIVERING PUNCH IN VIRTUAL REALITY EXERGAME

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**Objective:** Individuals with disabilities can experience health problems and greater obstacles to physical activity participation than the general population. VR-based exergames can be an alternative option to increase physical activity level because it is fun, relatively accessible and affordable. Punching in boxing requires complex movements, where the lower body is an effective contributor. A thorough understanding of the muscle activity involved during VR EXG is important to assess the potential benefits of VR EXG. This study aims to evaluate the differences in upper limb muscle activity of the dominant side in the standing and sitting position when delivering punch in VR EXG "Fitness Boxing" Nintendo Switch™ with aim of using it for individuals with lower limb problems.

**Methods:** The subjects of this study were 15 healthy adult men aged 21-39 years who underwent surface electromyography examinations on the four upper limb muscles (upper trapezius, anterior deltoid, biceps, triceps) of the dominant side when delivering straight, hook and uppercut punches during playing VR EXG "Fitness Boxing" Nintendo Switch™. The examination is carried out in two playing positions, namely standing and sitting position.

**Results:** The results of this study showed that there was no significant difference in the %MVIC values of upper trapezius (UT), anterior deltoid (DA), biceps (B) and triceps (T) of the dominant sides when the subject hit straight punch (*p-value* UT = 0.465; pDA = 0.904; pT = 0.865; pT = 0.319; trivial effect size), hook (*p-value* UT = 0.866; pDA = 0.753; pT = 0.509; pT = 0.801; trivial effect size), and uppercut (*p-value* DA = 0.776; pB = 0.753; pT = 0.509; pT = 0.801; trivial effect size). The only difference that was significant was only the %MVIC of upper trapezius muscle when delivering uppercut punch standing versus sitting position (*p-value* UT = 0.041; effect size = 0.251/small)

**Conclusion:** Standing or sitting position can be done while playing VR EXG "Fitness Boxing" Nintendo Switch ™, which should have the same effect on individuals who need increased physical activity but have conditions that cause them not able to do it in their normal (standing) position.

**Keywords:** virtual reality/VR, exergame/EXG, Nintendo Switch, boxing, muscle activity, electromyography/EMG, standing versus sitting position.