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GADJAH MADA
**PENGARUH JENIS PERANGKAT, ARM SUPPORT, DAN DURASI BERMAIN TERHADAP KELELAHAN OTOT DAN PERSEPSI
PENGERAHAN TENAGA PADA PEMAIN GIM MOBA SELULER**
Azzahra Khairuna, Ir. Rini Dharmastiti, M.Sc., Ph.D., IPM., ASEAN.Eng.
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

INTISARI

Pesatnya industri esports meningkatkan risiko kelelahan otot dan gangguan *musculoskeletal* akibat durasi bermain gim mobile yang panjang dengan postur statis. Penelitian ini bertujuan menganalisis pengaruh jenis perangkat (*smartphone* vs tablet), penggunaan *arm support*, dan durasi bermain terhadap kelelahan otot secara objektif melalui nilai Median Frequency (MF) pada *surface Electromyography* (sEMG), serta persepsi pengerahan tenaga subjektif menggunakan *Rating of Perceived Exertion* (RPE) selama sesi bermain 60 menit.

Eksperimen menggunakan desain *within-subject* yang melibatkan 12 pemain mahir *Mobile Legends* dominan tangan kanan serta menguji empat kondisi acak, yaitu *smartphone* tanpa *arm support*, *smartphone* dengan *arm support*, tablet tanpa *arm support*, dan tablet dengan *arm support* selama 60 menit. Respon objektif diukur melalui nilai *Median Frequency* (MF) *surface Electromyography* (sEMG) pada delapan otot (UT, ECR, FDS, APB kanan/kiri), sedangkan respon subjektif diukur menggunakan skala *Rating of Perceived Exertion* (RPE) Borg yang dianalisis menggunakan uji Linear Mixed Models (LMM) setiap 10 menit.

Hasil LMM menunjukkan durasi bermain memicu penurunan nyata nilai MF sejak 10 menit pertama ($p < 0,01$). Penggunaan tablet signifikan meningkatkan kelelahan dibanding *smartphone*, terutama pada otot UT kanan ($p = 0,024$) dan UT kiri ($p < 0,001$). Interaksi dua arah (perangkat dan *arm support*) signifikan memengaruhi MF otot UT kiri ($p < 0,001$), ECR kanan ($p = 0,031$), dan APB kiri ($p = 0,032$), membuktikan *arm support* efektif pada *smartphone* namun tidak efektif pada tablet. Pada data persepsi, interaksi tiga arah berpengaruh sangat signifikan terhadap nilai RPE di seluruh tubuh ($p < 0,001$) dengan beban tertinggi pada kondisi tablet tanpa *arm support* di menit ke-60 (RPE = 15,42 ± 0,43). Disarankan penerapan *micro-breaks* setiap 10 menit permainan untuk memitigasi risiko cedera dan bermain menggunakan perangkat *smartphone* dengan *arm support*.

Kata Kunci: RPE, *Arm Support, Smartphone,* Tablet, Kelelahan Otot, sEMG.

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ABSTRACT

The rapid growth of the esports industry increases the risk of muscle fatigue and musculoskeletal disorders due to prolonged mobile gaming sessions in static postures. This study aims to analyze the effects of device type (smartphone vs. tablet), arm support usage, and play duration on objective muscle fatigue via Median Frequency (MF) values using surface Electromyography (sEMG), as well as subjective rating of perceived exertion using the Rating of Perceived Exertion (RPE) during a 60-minute gaming session.

The experiment employed a within-subject design involving 12 right-handed skilled Mobile Legends players and tested four randomized conditions: smartphone without arm support, smartphone with arm support, tablet without arm support, and tablet with arm support for 60 minutes. The objective response was measured via MF values of sEMG across eight muscles (UT, ECR, FDS, APB right/left), while the subjective response was measured using the Borg RPE scale on the shoulders, forearms, and hands, which were analyzed every 10 minutes using Linear Mixed Models (LMM).

LMM results showed that play duration triggered a significant decrease in MF values within the first 10 minutes ($p < .01$). Tablet usage significantly increased fatigue compared to smartphones, particularly for the right UT ($p = .024$) and left UT muscles ($p < .001$). The two-way interaction (device and arm support) significantly affected the MF of the left UT ($p < .001$), right ECR ($p = .031$), and left APB ($p = .032$), proving that arm support was effective on smartphones but ineffective on tablets. Regarding perceived exertion, the three-way interaction had a highly significant effect on RPE scores across the entire body ($p < .001$), with the highest workload found in the tablet without arm support condition at minute 60 ($RPE = 15.42 \pm 0.43$). Implementing micro-breaks every 10 minutes of gameplay and playing on a smartphone with arm support are recommended to mitigate injury risks.

Keywords: RPE, Arm Support, Smartphone, Tablet, Muscle Fatigue, sEMG.