This study investigated the effect of location change of center of gravity (CG) and point of support (PS) in the body during standing lathe working on biomechanical muscular fatigue. Until today, workers who work in standing position often experience biomechanical muscular fatigue. By redesigning PS and CG in lathe workers from upright standing (US) to half-sitting with no support (HSWNS) standing position and half-sitting with support (HSWS) position, a more ergonomic standing position could be obtained. Therefore, biomechanical muscular fatigue can be reduced based on the concept of anaerobic energy metabolism (AEM) in which the concentrations of lactic acid and glucose change. This was an experimental study using pre- and post control group design. The population was 60 participants of manual lathe working training in Balai Latihan Kerja Industri dan Pengembangan (BLKIP) Surabaya. Samples were selected using criteria and in random. The sample size of US group was 10 subjects, HSWNS 10, HSWS 10, and Control 6 subjects. It can be concluded that, first, lathe workers who have or did not performed any activities for 3 hours showed no change of lactic acid and glucose concentration. CG and PS locations during lathe working in US position had higher AEM than that in HSWNS and HSWS standing position. Second, CG and PS location during lathe working in US position requires higher muscular contractions than that in HSWNS and HSWS standing position. Third, CG and PS location during lathe working in HSWS standing position results in higher comfort compared to that in US and HSWNS standing position. It is recommended that companies or institutions, whose workers have to work in static standing position, should change the position of their workers to half-sitting position which enable them to be more relaxed to reduce biomechanical muscular fatigue.