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GRAVITATIONAL RUNNING AND THE TACTICAL ATHLETE

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INTRODUCTION

For tactical athletes, maintaining a peak level of physical fitness at all times is essential to mission completion and survival. They must be prepared to deploy to any environment at all times, and seek training methods to gain an edge over enemies on the battlefield. The military places particular emphasis on minimizing injury risk while optimizing running performance, given the need to develop and maintain cardiovascular fitness, speed, and endurance. This sometimes leads to adopting alternative or untested training methods and products. The Pose Method® and ChiRunning® are two commercial running techniques that have become increasingly popular among United States military personnel (5,9,11,12). These techniques promote a Running Pose or slight forward lean, which enables gravity to propel the runner forward for improved performance and reduced injury risk (16,19). The purpose of this article is to review these gravitational running (GR) techniques from an evidence-based approach, then recommend whether to include GR techniques in the training of tactical athletes.

BACKGROUND

GR techniques promote a decrease in stride length and vertical displacement of the center of mass, with an increase in stride frequency and ankle movement, and a midfoot to forefoot strike pattern (12). The foremost element of these techniques is the assertion that a slight lean forward creates the potential energy for forward movement. Forward lean is followed by a passive falling motion using gravitational torque to produce forward movement and minimize stress on lower extremity muscular and tendinous structures by requiring less muscular effort (10). GR running instruction methods also promote a reduction in ground reaction force, which accompanies shorter strides and forefoot strike patterns (10). The major GR programs both claim to improve efficiency, speed, and prevent injuries (16,19). The Pose Method webpage states "the end result is faster race times, freer running and no more injuries!" (16). The ChiRunning website states: "regardless of your experience, ChiRunning will help you: "set yourself up for a lifetime of injury-free running… go farther or faster with less effort… lower impact to your joints," (19). Given these claims, we assessed the evidence related to the three major claims of improving running efficiency, speed, and reducing injuries.

RUNNING EFFICIENCY

GR practitioners advocate that it improves running efficiency but the evidence used to suggest that these techniques improve economy appear to be inconsistent and suggests this technique provides no mechanical advantage (10,14,17). In a comparison of GR technique with a control group using their typical running techniques, Dallam et al. found that the GR group experienced a significant increase in submaximal absolute oxygen (3.28±0.36 1 x min-1 to 3.53±0.43 x min-1; $p<0.01$) cost after 12 weeks of instruction, where the control group did not (7). Fletcher and colleagues found a week of GR (Pose Method) training had no significant impact on oxygen consumption or 2,400-m run time performance (10). While not statistically significant, the GR group improved its 2,400-m run time by a mean of 24.7 s, compared to the control group running three seconds slower. The standard deviation was much greater in the control group run times both pre- and post-test (63.5 and 62.2 s, respectively) compared to the GR group (10.1 and 7.1 s, respectively); this indicates more variability among the runners in the control group even before the study began (10). It seems that there may have been influential data points that affected the outcome of the analysis. Craighead et al. found no difference in running economy after eight weeks of GR instruction in the experimental versus control groups (6). It is important to note that all studies demonstrated a significant change in kinematic variables, such as a decreased stride length (137.25± 7.63 cm to 129.19± 7.43 cm; $p<0.05$), so it appears it is not a case of the participants not executing the technique, but rather the technique not improving running economy. The findings of Dallam, Fletcher, and Craighead are in agreement with previous work that has demonstrated a freely chosen stride frequency and length is most associated with optimal running economy (4). Given the above evidence, we find the claim that GR makes the runner more efficient is not supported by research.

SPEED

It is well established that sprint speed is the product of stride length and stride frequency. However, after initial acceleration of 0 – 10 m, it has been demonstrated in athletes that stride length is the main driving factor for maximal velocity rather than stride frequency (8). In a study involving 109 male and 79 female elite sprinters, Paruzel-Dyja et al. reported stride length as the most important parameter for males, while stride frequency was the most important ($r=-0.39$; $p\leq0.01$) parameter for females. They also correlated increasing body mass and body height with greater stride length and lesser stride frequency (15). This work by Paruzel-Dyja demonstrated that a "one-size-fits-all" running approach is inappropriate when attempting to maximize speed. The GR practice of shortening SL could hinder maximal sprint velocity for taller/heavier tactical athletes. Another principle of GR is the passive nature of the running technique aimed at minimizing ground reaction forces experienced by the runner. Researchers demonstrated that "exerting a large propulsive force during the entire acceleration phase, suppressing braking force when approaching maximal speed, and producing a large vertical force during the maximal speed phase are essential for achieving greater acceleration and maintaining higher maximal speed, respectively," (16). Thus, the practice of passively running and deliberately minimizing ground reaction forces may result in slower sprint speed. Sprinting is a major component of tactical movement; the "rush" is one of the three major individual movement techniques in the U.S. Army's doctrine (2). Tactical athletes must sprint to safe positions while under fire and while carrying external load. Thus, a slower sprint speed could make the tactical athlete more susceptible to enemy fire. The potential effects on tactical athlete performance and lethality must be evaluated before training tactical athlete *en masse* in a particular running technique.

INJURY REDUCTION

One of the claimed benefits of GR is a reduction in injuries. Although both the Pose Method and ChiRunning appear to decrease the eccentric work at the knee, it also appears to increases eccentric work at the ankle (1,13). Whether this reduces the risk of injury at some anatomical locations while increasing the risk at others is undetermined. Warr and colleagues found that heel strikers did not differ from non-heel strikers (midfoot or forefoot strikers) in terms of two-mile run performance or overuse injury rates among 341 male U.S. Army soldiers (18). Further, the Military Training Task Force of the Defense Safety Oversight Council found insufficient evidence in 2010 to recommend altering running stride length or cadence for injury reduction (3). There are some potentially positive aspects of GR in terms of shifting of stress from the knee to the ankle, potentially making it a suitable alternative for athletes with a history of knee injury (12). Also, to the authors' knowledge, there are no reports in peer-reviewed literature concerning GR style and injury risk for specific anatomic location and no data stratifying injury by running style. Thus, any claim that GR prevents injury does not appear to have sufficient support. Based on the current literature, further research and validation are needed before advocating for specific running techniques to reduce injuries among tactical athletes.

CONCLUSIONS

While GR instruction may have benefits for some, the science on running does not support it for everyone. Uniform/compulsory instruction to large populations may have unforeseen adverse effects and also waste personnel resources. GR technique should not become doctrinal or mandatory for military organizations or tactical athletes based on the current evidence. The current evidence does not support improvements in speed, running economy, or injury risk reduction through standardized instruction in a specific running technique. Further, the financial cost and the time required for GR training (up to 12 weeks, or possibly longer for experienced runners to adopt a specific running technique) do not justify investing in programs promoting GR instruction across a large military population. Military leaders should call for a more thorough evaluation of GR techniques and require empirical evidence to support the claims made by those who advocate for GR instruction. There is likely no single running technique that optimizes performance while minimizing injury risk for all runners.

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