Kinematic and muscle activation differences between a standard-pull up and a dynamic CrossFit “kipping” pull-up

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The standard pull-up (SPU) is an effective upper body resistance exercise used throughout the fitness community to build muscular strength. However, some athletes prefer activities that employ a wider range of muscles such as CrossFit which has become widely popular since the early 21st century. CrossFit introduced the kipping pull-up (KPU) which combines the SPU with a common move in gymnastics known as the “glide kip.” PURPOSE: The purpose was to compare overall EMS muscle activation and kinematics between a SPU and a KPU. We hypothesized that the additional motion generated by the kipping action of the KPU would significantly reduce the muscle activation in the upper body muscles compared to the SPU, while increasing the activation of hip-flexion and abdominal muscles. METHODS: This study was a within-subject, randomized, counterbalanced design of 11 male subjects who actively participated in CrossFit and were familiar with both styles of pull-ups. They had a mean age of 30 years (±3.53) and a mean ± SD of age 20 ± 3.5 years, height 178.6 ± 6.0 cm, weight 83.1 ± 3.8 kg, and body fat percentage of 20.5 ± 3.8%.

RESULTS

All kinematic variables evaluated during the study are presented in Table 1, comparing a single SPU and KPU. KPU kinematic variables (except range of the knee) were significantly different from SPU variables. This was a quantitative indication that there were significantly different movement patterns between the two different pull-ups.

The SPU utilized a wider range of muscles than the KPU, contributing to a more encompassing activation. Hip and knee angles were greater in a KPU when compared to a SPU (Figure 4 and 5). Subject 1 demonstrated this general trend and was representative of the findings for all subjects.

DISCUSSION

There were significant increases in muscle activation in the hip flexor and abdominal muscles, which generated a significant anterior/posterior swing. The significant reduction in upper body muscle activation was likely due to the added movement. A KPU may be a better overall workout because it incorporates more muscles. Additionally, reduced upper body muscle activation could theoretically allow an individual to complete more repetitions with less fatigue.

CONCLUSION

From Table 1 we were able to conclude that kinematically, these are two different pull-ups, because the KPU utilizes a more dynamic motion than the SPU. This difference is characterized by a substantial away in the sagittal plane for a KPU, and minimal movement in the ant/post direction for a SPU.

An important factor causing differences in a KPU was the hip angular velocity (p < .001) because it represents that there was a distinct kinematic difference in form between a KPU and SPU.

From previous literature, it was found that hip flexion was the major action of the SPU and KPU, and the ED and RA were significant contributors to the motion of the glute kip [11]. The significant activation of these lower body muscles may explain/compensate for the lack of upper body muscle activation in a KPU when compared to a SPU, so the individual can still raise themselves to the bar. The KPU utilized a wider range of muscles than the SPU, contributing to a more encompassing workout.

Further studies should explore the effect of a KPU on muscular fatigue when compared to a SPU, as well as other physiological phenomena associated with the KPU.

REFERENCES