Can You Chew Gum and Walk at Different Speeds? (Research Study)

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Can you walk and chew gum at the same time?

Yes.

But can you chew gum slowly and walk quickly at the same time?

Maybe. But only if you try really hard.

Walking and chewing gum may seem like the simplest of multitasks in a world where multitasking is not only the norm but the ideal. We don't really think about the speeds at which we do both of these tasks at the same time, but in a recent study, scientists wondered, are the speeds at which your chewing muscles move (as in mastication) and your lower limbs move related?

Previous research showed a link between clenching teeth and increased excitability of the α motor neuron pool for muscles of the upper and lower limbs. This increased excitability is propagated through the corticospinal tract and is reflected by enhanced reflex responses within the soleus (lower limb) and first dorsal interosseous (upper limb) muscles.

Consequently, it may be that there is increased neural drive related to chewing in comparison to that for gait, thus leading to a coupling of a person's step rate to chewing rates when the two are performed simultaneously. The inference from this is that the descending drive for mastication may not only lead to excitation of the α motor neuron pool for muscles of both the upper and lower limbs but may actually synchronize the muscle activity of the legs during walking.

A strong link between chewing and walking

Walking, chewing, and running are examples of oscillatory motor behaviors (rhythmical tasks). But each uses different muscles and body segments, are done at different speeds and have different goals. Each of these – and any rhythmic motor pattern – uses neuronal circuits called central pattern generators (CPG's) to help perform these tasks. CPG's are biological neural circuits that produce rhythmic outputs in the absence of rhythmic input yet are flexible in response to sensory input. A CPG requires:

1. two or more processes that interact such that each process sequentially increases and decreases, and
2. as a result of this interaction, the system repeatedly returns to its starting condition.

The neural mechanisms underlying these behaviors are very complex and are controlled by the central nervous system with both somatosensory feedback (from your skin, bones, joints, muscles, heart, lungs, eyes, organs, etc.) and higher executive function coordinating it all (should I go faster? Is this the right speed? Can I stop now?).

The study, *Coupling of motor oscillators – What really happens when you chew gum and walk?,* examined the impact that chewing gum at different speeds (i.e. fast, slow, preferred) had on walking performance for fifteen young healthy adults and fifteen healthy older participants. Chewing rates were measured by Electromyography (EMG) recorded from the masseter muscle. For gait, accelerometers mounted on the lower trunk and lower leg were used to determine the timing of individual steps.

In addition, a 20-foot Zeno pressure-sensitive walkway was used to provide additional spatiotemporal gait measures**.** Average (mean) and IIV measures were calculated for step length (cm), step time (sec), and gait velocity (cm/sec). This data was processed using Protokinetics PKMAS software.

The study's results demonstrated a strong link between chewing and walking for all study participants, with increases or decreases in a person's chewing rate leading to similar changes in their stepping rate (and hence walking speed). The results revealed that step rates (and hence walking speed) were strongly influenced by chewing rate, with both the young and older adults walking either faster or slower depending on the specified chewing rates.

One explanation for this coupling is that the neural drive related to chewing entrains the muscles involved in stepping. The coupling of stepping with chewing rates for all individuals was observed despite the older adults tending to walk slower overall.

Chewing influences gait speed

A prominent finding from the study was that changes in the rate of mastication had a significant impact on stepping rates (and, consequently, gait velocity) for both the young and older adults. When individuals chewed at a faster or slower pace, their step rate changed in a similar, systematic fashion.
An individual's step rate during walking was tightly linked to the rate at which they were chewing.

While there would seem to be no doubt that the rhythmical action of chewing had a strong driving influence on an individual's gait, the question of importance lies in the physiological basis for chewing driving a person's gait. Previous research has demonstrated that mastication is a complex motor process, arising from the combination of neuro-oscillatory output from central pattern generators (CPG's) within the brainstem. One possible explanation of chewing driving gait is that the greater neural input related to mastication may effectively lead to coupling of step rate with chewing rates.

However, these CPG's do not operate in isolation. Their resultant neural output is moderated both by descending signals from higher motor centers and sensory feedback from receptors within the face and mouth. Furthermore, those specific muscles involved in chewing receive bilateral neural signals from both motor cortices. In contrast, the CPGs involved for gait are, for humans, less well developed, with the lower limb muscles central to walking only receiving input from a single, contralateral hemisphere.

Consequently, it may be that there is increased neural drive related to chewing in comparison to that seen for gait, thus leading to a coupling of a person's step rate to chewing rates when the two tasks are performed simultaneously. The inference from this is that the descending drive for mastication may not only lead to excitation of the α motor neuron pool for muscles of both the upper and lower limbs but may actually entrain the muscle activity of the legs during walking. Irrespective of the underlying physiological mechanism, the results show that changes in chewing speed tends to drive stepping rates (and hence gait speed) in both young and older adults.

The main findings of this study were that the rate at which a person chewed had a strong driving influence on the stepping rate (and hence walking speed) for both young and older healthy adults.