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## Can the use of an alternatively designed tamper alter spine posture and risk of upper limb injury while tamping espresso?

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### ABSTRACT

Tamping is the process of compressing espresso grinds in order to pull shots of espresso and has been identified as one of the most strenuous tasks performed by baristas due to relatively high force and repetition as well as awkward spine and upper limb postures. Therefore, the current study aimed to determine if an alternatively designed tamper is able to alter spine posture and upper limb risk of risk while tamping. To test this, the current study measured 1) three-dimensional thoracic and lumbar spine posture using electromagnetic sensors adhered over the spine; 2) force applied to the tamper using a force plate; and 3) risk of upper limb injury using RULA and the Strain Index while tamping with a traditional vertical handle tamper and a flat handle-less tamper. Ten experienced baristas each performed 20 tamps (10 with the traditional tamper and 10 with the flat tamper; order randomized) of standard weight/grind espresso. Tamping with the flat tamper resulted in more neutral thoracic and lumbar spine postures and reduced force applied when using the flat tamper. The flat tamper also resulted in a lower score for both RULA and the Strain Index indicating a lower risk of injury to the upper limb. Based on the findings of this study, a flat, handle-less tamper has the potential to be a more ergonomically effective tool for tamping espresso grinds.

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### Relevance to industry

Reporting of work-related low back and upper limb pain is prevalent among baristas. Alternatively designed tampers which help to reduce non-neutral postures may help reduce risk of pain and/or injury in the espresso-making industry.

### 1. Introduction

When preparing espresso-based beverages, tamping is the process of compressing espresso grinds in a basket of a portafilter to create a dense puck before water is passed through to pull shots of espresso. Tamping ranges from fully manual (with the use of a handheld tamper) to mechanically assisted tampers equipped with a lever arm to assist the barista, to fully automatic tampers. However, anecdotally, cafés may often choose manual tamping as baristas feel that they have more control over the density of the puck

and the quality of the pulled shot.

Recent work (Dainty et al., 2014) identified the act of manual tamping when preparing espresso as requiring the most awkward spine and upper limb postures and highest forces compared to other tasks performed by baristas. As a result, the authors concluded that tamping is the most physically demanding part of making espresso-based beverages. Further, despite an average age of 26 years in that particular study, 73% of the surveyed baristas reported a history of low back pain and half of these individuals attributed it to their job (Dainty et al., 2014). This is concerning given that the lifetime prevalence of low back pain is only slightly higher at 80–85% (Cassidy et al., 2005). Further, disability and missed work are most commonly due to low back pain (Hoy et al., 2014), and the work of Dainty et al. (2014) showed the coffee serving industry is not exempt. Moreover, 68% of those surveyed by Dainty et al. (2014) reported previous shoulder pain with half of those individuals attributing it to their job. Many cafés and larger corporations have moved to automated and semi-automated tampers which have reduced these risk factors; however as stated above, debate continues regarding the quality of the espresso produced when the grounds are tamped in this fashion. In

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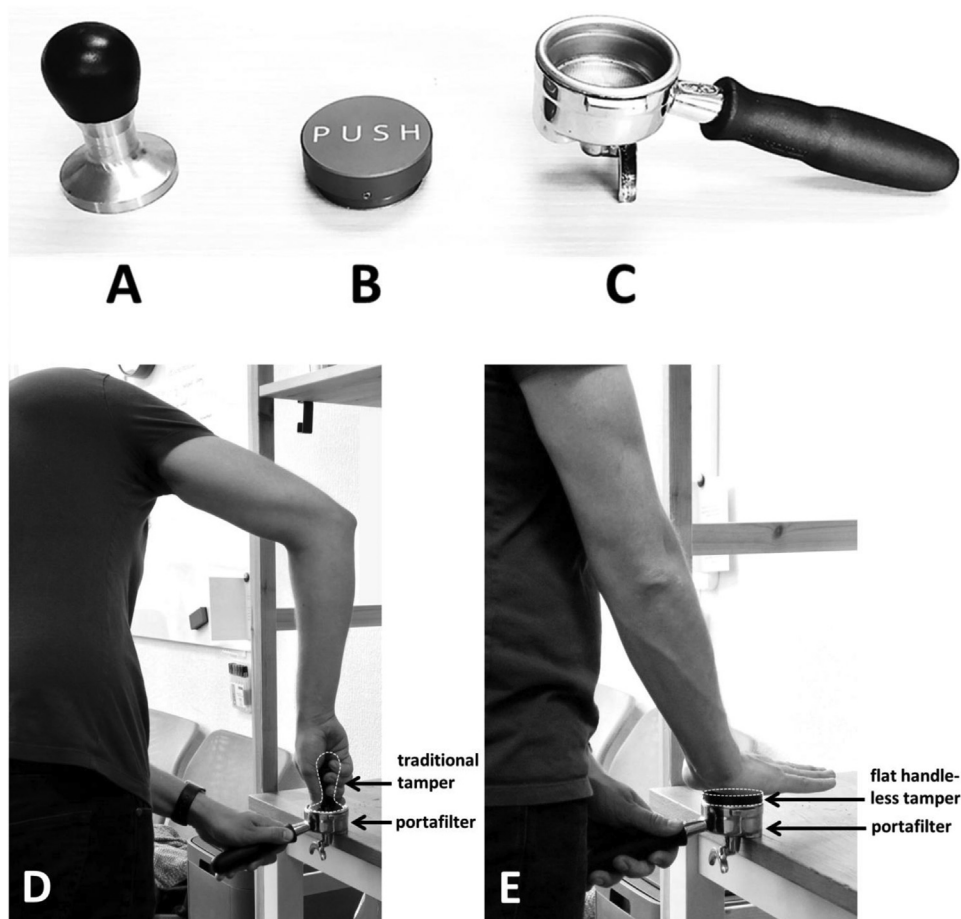
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addition to the low back and shoulder, baristas have also reported work-related pain in their wrists (41%), elbow (9%), neck (44%), and knees (53%) (Dainty et al., 2014), further emphasizing the risk of occupational injuries.

While automatic and semi-automatic tamping machines likely reduce risk of injury, an alternatively designed handheld tamper may bode the ergonomic benefits of a tamping machine while also allowing baristas control over the tamping style and force application. The vertical handle used with traditional tampers (Fig. 1), and subsequently how the barista has to hold and apply force through these traditional tampers, is what results in awkward, non-neutral spine and upper limb postures (Dainty et al., 2014). Therefore, an alternative design could help reduce these non-neutral postures, both in the spine as well as the upper limb, which are known to increase risk of injury (Pope et al., 2002; Punnett et al. 1991, 2000). Previous studies have examined the redesign of various handheld tools including those used for carpet weaving (Motamedzade et al., 2007), wire-tying (Li, 2002), clamping (Jung and Hallbeck, 2005), wrench use (Dianat et al., 2017), and food serving (Williams, 2003). In all of these studies, handle shape, similar to the current study, was the focus of the redesign. Specifically, in this study a handle-less, flat tamper (this study utilized the PUSH tamper by Clockwork Espresso Ltd; Fig. 1B and E) would likely significantly alter upper limb posture, but would these changes also decrease risk of injury? And would these changes also improve spine posture? Given that upper limb and

spine pain is very prevalent in the espresso-making industry (Dainty et al., 2014), this design change may help improve health among baristas. Further, Starbucks Corporation, one of the world's leading coffeehouse chains, currently has over 24,000 stores worldwide, employing a significant number of baristas (Starbucks.com). Combined with the popularity of other coffee houses, both chains and independent coffeehouses, the number of baristas who can benefit from this intervention is substantial.

The overall goal of this study was to determine if spine posture and risk of upper limb injury could be modified by using an alternative style tamper while making espresso. The PUSH tamper (Clockwork Espresso Ltd, Durham, UK) was used in the currently study given its flat, handle-less design. The PUSH tamper was originally designed to increase tamping consistency but its unique design has the potential to alter upper limb and spine posture, and thus risk of injury while tamping. It was hypothesized that risk of injury to the spine and upper limb would be reduced when tamping with a flat handle-less tamper compared to the traditional handle design. Risk of injury was defined as the potential of sustaining an injury. It is important to note that an elevated risk of injury does not mean that an injury will occur, but rather that the potential of injury is elevated. Postures deviating from neutral or an increased Rapid Upper Limb Assessment (RULA) (McAtamney and Corlett, 1993) or Strain Index (Moore and Garg, 1995) score (described in section 2.3.3) were considered to elevate risk of injury.



**Fig. 1.** The tamping devices utilized by the participants. (A) traditional tamper design; (B) flat tamper; (C) standard 58 mm portafilter. (D) Typical posture assumed while tamping with a traditional tamper (outlined with dashed white line); (E) Typical posture assumed while tamping with the flat handle-less tamper (outlined with dashed white line).

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