The tricks to playing extra time in the World Cup

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England's shootout victory against Colombia was the latest World Cup knockout game to go into extra time—and pundits noted how, as ever, the 30-minute period placed extra physical demands on the players, as

well as affecting their ability to execute skills such as passing and dribbling. What can be done to give teams a winning edge when a deadlocked game has a gruelling further 30 minutes added? Research at the University of Huddersfield has been finding out.

Carbohydrate gels and caffeine-infused chewing gum are possible solutions. The five-minute window before extra time begins is crucial, but teams might also have to develop better nutritional strategies that cover the period before kick-off and the half-time break.

The problem in maintaining performance during extra time has been a major research area for Dr. Liam Harper, Senior Lecturer in Sport, Exercise and Nutrition Sciences at the University. It was the subject of his doctoral thesis and he has authored a succession of articles that deal with extra time and a wide range of related topics. He is unsurprised that 50% of the knockout matches so far have required extra time.

"Four years ago in Brazil, half of the knockout games went to extra time—the highest number ever and it will probably be pretty similar this year," said Dr. Harper. This is because the overall quality and competitiveness of teams is improving, he added, but it is observable that the extra 30 minutes leads to a drop-off in physical and skill performance.

Football fatigue

Among Dr. Harper's articles is Technical Performance Reduces during the Extra-Time Period of Professional Soccer Match-Play and more recently Are soccer players going the extra mile in extra-time? in the *British Journal of Sports Medicine*. It quantifies a reduction in the number of successful passes and dribbles in 18 matches involving professional European teams. This potentially shows that players are less likely to be involved in their team's build-up play during extra time

compared to during the first two 45 minute halves.

"We have looked at a lot of the physiological responses to explain this and the main one is a change in energy substrate use. Typically, towards the end of a 90-minute game you start to reduce the amount of muscle glycogen (stored carbohydrate). So it is likely this reduces further during extra time. Muscle glycogen stores are the source that contributes most to high-intensity running and sprinting, which is crucial to successful performance in football," said Dr. Harper.

"When you get into extra time you start using fat as a fuel more predominantly, which is not as effective for those bouts of higher-intensity running. When you deplete energy sources you are going to rely on ones that aren't as efficient and that's probably one of the reasons why there is a drop-off in performance. However, there are a number of factors that may contribute to this, such as self-pacing by the players the environment, and the current score line amongst others."

Dr. Harper and his colleagues have worked with a number of leading UK clubs. For example, there was a collaboration with Barnsley Football Club that appraised the performance and rate of recovery of players who took part in the full duration of three games—including one that went to extra time—within a week.

During a study with Sunderland Association Football Club's academy, young players were given carbohydrate gels in that five-minute break before extra time.

"We found that dribbling accuracy improved but we weren't able to rescue reductions in physical performance. One of the reasons is that we didn't give them any carbohydrate at half time or during the warm-up either, so more research around nutritional strategies targeted towards potentially playing extra time is required" said Dr. Harper.

Recovery rates

It is now permitted at the World Cup for a fourth substitute, to be brought on during extra time. This means is important for coaches to identify the players who are particularly susceptible to fatigue after 90 minutes and should therefore be taken off in favour of fresh legs. However, those players who are particularly adept at penalties may be favoured when making a substitution in extra time.

Research into the subject of extra time performance continues and later in the year Dr. Harper will begin to supervise the work of a new Ph.D. project to be carried out by a University of Huddersfield Sports Science graduate. But the take-up of new nutritional ideas in the professional game is mixed.

For example, Dr. Harper and colleagues conducted a survey of 46 practitioners working in professional football.

"We found that they do typically advocate some kind of nutritional intervention before extra time—but not all of them. And a lot of time it might just be water that they provide the players instead of carbohydrates, whereas providing something that can hydrate the players as well as provide carbohydrate will likely be more beneficial.

"When you watch a game on TV and it goes to extra time they have the cameras on the players and you will see that the practices could definitely be improved," said Dr. Harper.

Provided by University of Huddersfield