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Protein Plus Carbohydrate Does Not Enhance 60-km Time-Trial Performance

In a recent issue of this journal (Vol. 19, No. 2), Saunders and colleagues published a study that addressed a topical and controversial area of investigation, namely, whether the addition of protein to a carbohydrate (CHO) drink can improve endurance-exercise performance. The authors employed a very practical research design in which participants performed a simulated time trial (three laps of a hilly 20-km course) while ingesting a CHO-only drink or a drink matched for CHO content that also contained a protein hydrolysate (CHO-ProH). Results showed there was no statistically significant difference in performance over 60 km, with mean times of 134.4 ± 4.6 and 135.0 ± 4.0 min for the CHO and CHO+ProH groups, respectively. However, the authors did not draw this conclusion, even though it addressed their primary research question. Rather, they focused on the secondary observation that "late exercise performance" appeared to be enhanced with CHO-ProH ingestion compared with CHO.

Saunders and colleagues reasoned it was appropriate to focus on the later stages of exercise, since small potential differences in performance between treatments might be detected with greater sensitivity. This, of course, ignores the fact that there was no difference in actual performance. Unfortunately, interpretation of their data is confounded by the fact that exercise intensity was not standardized during the initial portion of exercise. The latter design has become common in volitional performance studies and has been shown to detect small differences in performance with the ingestion of different combinations of carbohydrates (Currell & Jeukendrup, 2008a). Since there was no difference in overall performance and cyclists were faster in the later stages with CHO+Pro, this would suggest that they were slower during the first phase of the time trial.

A second concern is that Saunders and colleagues recruited participants who were described as "recreationally competitive male cyclists." We and others have previously noted that it can be problematic to use lower level cyclists in time-trial performance tests (Currell & Jeukendrup, 2008b; Hopkins, Schabort, & Hawley, 2001). Although the authors did not report individual times for their participants, the average time to complete a 60-km time trial (even a hilly one) suggests that the average performance level of the cyclists recruited for this study was not high (60 km in 135 min = 26.7 km/h; with a standard deviation of almost 17 min). Even on a hilly course this cannot be regarded as high-level performance. By comparison, participants in one of our studies that employed a similar research design covered 25% more distance in the same amount of time (van Essen & Gibala, 2006). Regardless of actual time (which can be influenced by the nature of the simulated time trial), a more sensitive measure of performance is power output. With the setup used, power was

not measured and the authors' measurement of performance was reliant on a software package that simulated distance and speed. To our knowledge there are no studies in the literature validating the performance measurement used in this study or even the setup that was used. There are also no reliability data for this setup, this performance-test duration, and this particular group of cyclists. If the conclusion of a study were dependent on a biochemical assay that was not validated and with a reliability that was unknown, a paper would not be acceptable. Why would we make an exception in exercise sciences when performance is the main outcome measure?

A potentially fatal error in the design is the feedback given to the participants in combination with a drink that is difficult to blind to them. The participants were told the time, as well as distance. This means that they know their performance and could use this information in the next trial. It has been shown that the information given to participants influences the outcome of the performance measure (Nikolopoulos, Arkinstall, & Hawley, 2001), and this can invalidate the results of intervention studies (Currell & Jeukendrup, 2008b). A problem with all studies that use carbohydrate and protein drinks is the blinding of the trials. It is difficult to match the consistency and taste of the drinks that contain protein and carbohydrate or only carbohydrate. It is unlikely that simply adding vanilla flavor is enough to match the two drinks. It should be common practice to retrospectively report how many participants identified the drinks correctly.

So this is another study in a series of studies that has important methodological shortcomings. The problem, however, is not that the design is not perfect but that these limitations are not recognized and discussed. Most important, the conclusion, as well as the title of the paper, is misleading. Besides this, in order to be confident about an effect of an intervention there must be almost unequivocal findings by all studies (which certainly is not the case) or there must be a plausible mechanism. So far no one has come up with a plausible mechanism for why protein added to a carbohydrate drink would improve performance over a carbohydrate drink alone. So for now, there is no reason to recommend carbohydrate and protein drink during exercise to athletes involved in endurance events.

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Response

We appreciate the comments from Drs. Jeukendrup, Tipton, and Gibala regarding our recent paper (Saunders, Moore, Kies, Luden, & Pratt, 2009). In their letter, concerns were raised regarding methodological and interpretive aspects of our study. It is fair to recognize that some of these methodological issues could have warranted further discussion. This may have alleviated some of the authors' concerns with the study protocols, as well as acknowledging factors with the potential to influence study outcomes. However, from our perspective, the discussion addressed factors we felt most likely to influence the results of the study. This included various issues debated in the recent literature (Saunders, 2007; van Essen & Gibala, 2006), such as differing carbohydrate or caloric levels, different protein types, and varying performance protocols. Although the authors raised some legitimate issues, it should also be acknowledged that a comparable list of methodological limitations or omissions could be raised for most studies examining ergogenic aids and athletic performance, depending on the reader's perspective. Researchers conducting future studies in this area should consider the authors' comments in the design of their protocols. However, they should also consider the most straightforward interpretation of the observed differences between treatments in this study—that protein may provide performance benefits for endurance athletes. It is clear from the authors' comments that there is not yet a consensus regarding this position. However, the potential effects of protein on performance should not be dismissed unless studies can show no ergogenic effects of carbohydrate-protein ingestion in research designs that have adequate statistical power to detect athletically relevant differences in performance.

The authors expressed concerns regarding the absence of "a plausible mechanism" to explain protein's ergogenic effects. This is a limitation of the existing literature that was acknowledged in the discussion of the paper. Support for an ergogenic effect would be stronger with direct evidence supporting a mechanism of action. However, numerous observations remain unexplained in science, and the lack of a known mechanism should not prevent researchers from considering a new hypothesis. At least four recently published studies have reported enhanced endurance with carbohydrate-protein ingestion—enough to suggest that the proposed effects are not merely the result of a statistical or methodological anomaly. The authors suggest that the absence of "almost unequivocal findings by all studies" is evidence that carbohydrate-protein is not ergogenic, but few nutritional aids could meet this criterion standard. For example, it is commonly accepted that carbohydrate ingestion

improves endurance performance. However, Armstrong and Maresh (1996) reported that only 38% of studies investigating carbohydrate ingestion observed significant positive effects compared with water/placebo. This does not mean that carbohydrate ingestion does not improve performance. However, it demonstrates that an effect on performance may only be shown significantly under the appropriate set of exercise conditions and when studies are designed with appropriate statistical sensitivity to detect these changes.

It was in this spirit that the current study was designed. We proposed that long time trials may lack the sensitivity to detect small (but functionally significant) differences between treatments. Thus, we purposely examined late-exercise performance because our available sample would not provide appropriate statistical power to consistently detect functionally important differences in overall 60-km performance. In addition, because beverage consumption began at 5 km, treatment differences would be nonexistent in the earliest stages of exercise, further impairing sensitivity to detect early-exercise differences. Jeukendrup, Tipton, and Gibala suggested we should have emphasized the lack of significant treatment differences in 60-km times. Although not a primary focus of discussion, these data were reported in the abstract, results, and discussion of the paper. Our justification for emphasizing the late-exercise segment of the trial was discussed expansively throughout the paper. It is also important to clarify that the 60-km times reported in their letter were reversed from the correct times reported in the manuscript (134.4 ± 4.6 and 135.0 ± 4.0 min for CHO+ProH and CHO, respectively). The authors stated that "since there was no difference in overall performance and cyclists were faster in the later stages with CHO+Pro, this would suggest that they were slower during the first phase of the trial." While this could be a potential concern with our design, data available from the paper (Table 2) demonstrate that this did not occur. Times for the first 40 km were almost equal (90.0 and 90.1 min for CHO and CHO+ProH, respectively), and times for the first 55 km actually favored CHO+ProH by a small margin (118.1 and 117.9 min).

In conclusion, we accept the authors' criticism that some methodological issues could have been discussed in more detail, and we cannot directly prove that these factors had no influence on the outcomes of the study. However, we disagree that the study has major methodological shortcomings. Carbohydrate and protein ingestion did not affect early-exercise performance but improved late-exercise performance significantly, as hypothesized. Although there is currently no general agreement, multiple recent studies have reported that carbohydrate-protein ingestion improves performance. We agree with Jeukendrup, Tipton, and Gibala that no clear mechanism is presently available to explain this positive effect and support initiatives to further investigate such mechanisms. We feel that our primary conclusion, as well as the title of the paper, is entirely warranted.

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