Egg Labeling for Gastric-Emptying Studies

TO THE EDITOR: We were delighted to read some back-to-basics research in the November *JNM* and thank Knight et al. (*1*) for a much-needed evaluation of gastric-emptying labeling efficacy. Mixing a radiopharmaceutical and meal does not guarantee either successful labeling or, indeed, maintenance of the label in vivo. Nonetheless, a variety of different meal compositions have been used with varying success for gastric-emptying studies, including but not limited to chicken liver, pancakes, mushrooms, noodles, eggs (omelet, scrambled, whole eggs, egg whites, commercial egg substitute, and hard-boiled eggs), rice pudding, beef stew, cottage cheese, and porridge (*1–3*). In Australia, there is anecdotal evidence that solid-phase gastric-emptying studies are also performed using marshmallows, toasted sandwiches, commercially available egg-based breakfast burgers, and even egg-based milk shakes. In recent years, the need for palatability and ease of preparation and, on occasion, the need to address cultural issues appear to have played a role in the emergence of alternative meal types. Unfortunately, many of the alternative meal types have not had reference values validated or indeed the label efficacy determined. Moreover, widespread use of the microwave as a more convenient cooking method may have a significant impact on label integrity; one cannot simply adopt established reference values for pan (griddle)-cooked eggs. We thank Knight et al. (*1*) for highlighting these issues.

Despite recognition that the use of whole eggs is in widespread practice, gastric-emptying studies have traditionally required egg whites only—in theory, to improve label integrity in vivo (*4*). Consequently, we were cautious in interpreting the results comparing egg substitute with whole eggs without an account of the performance of egg-white meals. A comparative analysis of other common methods of meal preparation would have strengthened the external validity of this research.

In a recent investigation at Charles Sturt University, comparative analysis was performed on the labeling efficiency of eggs (whites, whole eggs, and precooked commercial breakfast burgers), tofu, marshmallows, and beef (raw meat and precooked commercial breakfast burgers). The method of cooking (precooked, griddle, or microwave) and the time of radiopharmaceutical administration (raw, semicooked, or cooked) were also evaluated. These results (unpublished) showed that the labeling efficiency at 1 h after incubation in a simulated gastric environment for egg whites (96.1%) and whole eggs (94.8%) was similar to the labeling efficiency for beef (97.0%), whereas poorer efficacy was noted for precooked meat (83.7%), precooked eggs (66.7%), tofu (64.4%), and marshmallows (29.6%). The tofu was confounded by a large disparity in results between griddle-cooked tofu (81.3%) and microwave-cooked tofu (47.5%). It mattered naught whether the radiopharmaceutical was added to the raw (96.2%) or semicooked (96.0%) meal; however, addition to precooked food performed poorly (75.1%). Similarly, whether a griddle (96.1%) or a microwave (96.2%) was used as the method of cooking was inconsequential, after tofu was excluded.

The results from Charles Sturt University support the use of egg substitute as an alternative to both egg whites and whole eggs, although the findings for whole eggs between microwave and griddle cooking are discordant with those of Knight et al. (*1*). In the interest of maintaining scintigraphy as the gold standard for gastric-emptying evaluations, we hope that practitioners use informed decision making before adopting an alternative, nonvalidated meal type.

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REPLY: We appreciate the comments by Drs. Currie and Wheat on our study that evaluated different methods to prepare an egg-based radiolabeled meal for gastric-emptying scintigraphy (*1*). The message of our study was that labeling methods and cooking methods need to be evaluated for any solid meal before one can adopt it for performing a gastric-emptying study. We also demonstrated in our paper that in vitro evaluation of stability in "simulated gastric conditions" may give different results if the incubation solution is dilute hydrochloric acid rather than human gastric fluid, which would contain pepsin in addition to acid. In attempting to directly answer Drs. Currie and Wheat, we find that the data mentioned in their letter are brief and omit adequate details on how their foods were combined with radiotracers and how cooking, digestion, and quantification were performed. Our studies support using a low-fat egg-substitute meal (EggBeaters; ConAgra Foods, Inc.), which is the meal suggested by a consensus working group of the Society of Nuclear Medicine and the American Neurogastroenterology and Motility Society (*2*). We agree on the importance of developing alternative meals and would urge the researchers at Charles Sturt University to proceed with full publication of the details of their studies.

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