

## FoodFinder: developing a rapid low-cost crowdsourcing approach for obtaining data on meal size from meal photos

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Capturing meal images using mobile phone cameras is a promising alternative to traditional dietary assessment methods. Acquiring photos is reasonably simple but nutritional content analysis of images is a major challenge. Automated food identification and portion size assessment is computationally and participant intensive; relying on participant feedback for accuracy<sup>(1)</sup>. Dietitian analysis of photos is accurate but time-consuming and expensive<sup>(2)</sup>. Crowdsourcing could offer a rapid low-cost alternative by utilising the life-long experience that all humans have in food identification. Previous crowdsourcing methods include the Eatery app, which produces a simple 11-point ‘healthiness’ scale for each meal<sup>(3)</sup> and the PlateMate system, which creates a list of all individual foods with portion sizes, energy and macronutrient content<sup>(4)</sup>. While the Eatery produces limited and subjective data on meal content, PlateMate represents a complex integrated system of multiple tasks requiring on average 25 workers, costing £2.75 and taking 90 min per image. For feasible data-capture in a large-scale longitudinal studies, crowdsourcing data from meal photos needs to be cheaper and quicker. We aimed to develop a simpler task and tested its feasibility for crowdsourcing dietary data.

FoodFinder, a single task for identifying food groups and portion sizes, developed using Qualtrics ([www.qualtrics.com/](http://www.qualtrics.com/)), and linked to the Prolific Academic (<https://prolific.ac/>) crowdsourcing platform for recruitment and reimbursement of a UK crowd. Thirty meal photos with measured total meal weight (grams) were analysed by a dietitian and crowds ranging in size from 5 to 50 people. The difference between actual meal weight (the gold-standard) and total meal weight estimated by different sized crowds and ratings by a dietitian were compared to each other. To establish group consensus crowd estimates were weighted by majority agreement<sup>(5)</sup>. Bland-Altman analysis assessed agreement with actual meal weight.

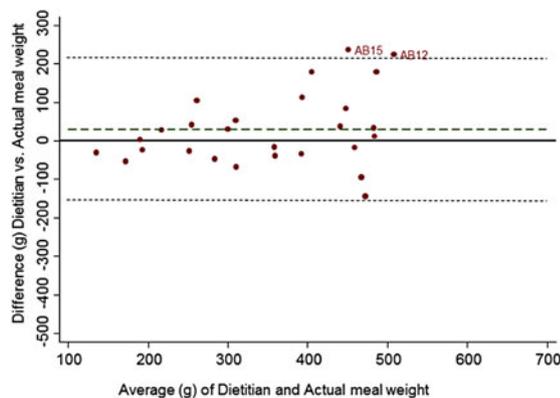


Fig. 1

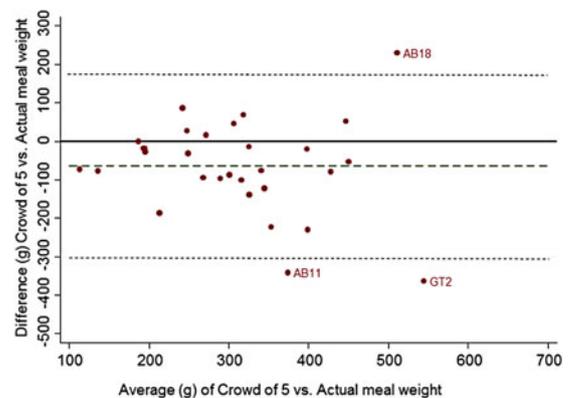


Fig. 2

A crowd of 5 people underestimated true meal weight by 63 g, equating to 15 % of actual meal weight with limits of agreement (LOA) from –299 to 174 g. In comparison experts overestimated by 28 g equating to 9 % of actual meal weight with LOA –158, 214 g. With a crowd of 5 people, crowdsourcing cost £3.35 and took a mean 2 mins 55 sec (SD 2 min 6 sec) per image. A crowd of 50 had similar accuracy and limits of agreement (–65 g LOA –278, 149 g) but was more expensive. Further development of FoodFinder is required to make rapid low-cost analysis of meal photos via crowdsourcing a feasible method for assessing diet.

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