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Original article

Criterion validity of the visual estimation method for determining patients' meal intake in a community hospital

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SUMMARY

Background & aims: The accuracy of the visual estimation method is unknown, even though it is commonly used in hospitals to measure the dietary intake of patients. We aimed to compare the difference in the validity of visual estimation according to the raters' job categories and tray divisions, and to demonstrate associations between meal characteristics and validity of visual estimation in a usual clinical setting in a community hospital.

Methods: We collected patients' dietary intake data in usual clinical settings for each tray in 3 ways: visual estimation by nursing assistants, visual estimation by dietitians, and weighing by researchers (reference method). Dietitians estimated the dietary intake using 2 divisions, namely, whole tray and food items. Then we compared the weights and visual estimation data to evaluate the validity of the visual estimation method.

Results: Mean nutrient consumption of target trays was significantly different when using the visual estimation of target trays than when using the weighed method (visual estimation by nursing assistants [589 ± 168 kcal, 24.3 ± 7.0 g/tray, $p < 0.01$], dietitians' whole trays [561 ± 171 kcal, 23.0 ± 6.9 g/tray, $p < 0.05$], food items [562 ± 171 kcal/tray, $p < 0.05$], and dietitians' food items [23.4 ± 7.3 g/tray, $p = 0.63$]). Spearman's correlations for both methods were very high for energy ($\rho = 0.91$ – 0.98 , $p < 0.01$) and protein intakes ($\rho = 0.88$ – 0.96 , $p < 0.01$), respectively. The limits of agreement in the Bland–Altman plot for both dietary intake categories were –121 kcal to 147 kcal/tray and –6.4 g to 7.0 g/tray (nursing assistants, whole division), –122 kcal–106 kcal/tray and –6.7 g to 5.5 g/tray (dietitians, whole divisions), and –82 kcal to 66 kcal/tray and –4.3 g to 3.9 g/tray (dietitians, food items divisions). High intake rate of grains was significantly associated with decreased odds of a difference between two methods based on the nursing assistant's whole tray evaluation (odds ratio [OR]: 0.85; 95% confidence interval [CI]: 0.76–0.94) and the dietitians' whole tray (OR: 0.80; 95% CI: 0.72–0.89) and food items evaluations (OR: 0.64; 95% CI: 0.56–0.73), respectively. In addition, minced meals were also associated with a difference between two methods, for the nursing assistants' whole tray (OR: 3.53; 95% CI: 1.66–7.51) and dietitians' food items (OR: 2.92; 95% CI: 1.37–6.22).

Conclusions: Visual estimation by nursing assistants and dietitians correlated highly with the weighing method although the limits of agreement were wide. Nursing assistants and dietitians should pay attention to low consumption and modified texture meals when evaluating dietary intake using the visual estimation method.

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1. Introduction

Obtaining an accurate view of patients' dietary intake is becoming increasingly important in hospitals worldwide. The European Society for Clinical Nutrition and Metabolism (ESPEN) has issued guidelines regarding the screening, assessment, and monitoring of nutritional status, taking into consideration dietary consumption [1,2]. Visual estimation is generally used in hospitals to measure patients' dietary intake. In this simple and easy-to-perform method, raters directly view a plate of food and evaluate plate waste to measure the patients' meal intake. Nurses or nursing assistants check the dietary consumption of inpatients as a routine part of their work, while dietitians usually evaluate the detailed dietary intake of patients at nutritional risk.

However, a reliable and valid process of visual estimation, which is feasible within the usual clinical setting, has not been established because previous studies indicate some limitations. First, few studies examined the method's validity in the usual clinical setting. Comparing studies by Bjornsdottir et al. and Berrut et al., which were conducted under different conditions, the validity of visual estimation of patients' dietary intake was lower in actual clinical settings. Second, few studies have examined the difference in validity through detailed processes, e.g., rater's job categories, tray divisions, etc. [4,5]. Nursing staffs such as nursing assistants, who routinely estimate patients' dietary intake in many hospitals, often do not have adequate knowledge, attitude, or skills of nutritional care [6,7]. Although visual estimation by dietitians is considered more accurate than estimations by other medical staff such as nursing assistants, only one study has compared the validity of visual estimation by dietitians and other medical staff (nurses and physicians); however, the study was not conducted in the usual clinical setting [4]. Furthermore, few studies directly compared the validity of visual estimation for different tray divisions in hospitals. Especially for whole trays division, validation study was conducted only in a small-scale study in long-term care, even though it is very simple and less demanding [8,9]. Third, meal characteristics, which have lower reliability and validity, such as texture of meals and percent consumption, were unclear. Although a difference in validity was identified when using the dietary consumption method, a correlation between the two has not been specified clearly [3,10]. Shirwin et al. compared the validity of general meal and modified texture meal estimates using the visual estimation method; however, the setting was long-term care and minced meals, which are often served to elderly patients, were not included [11].

Therefore, the aim of this study was to examine criterion validity of patients' meal intake using the visual estimation method in a community hospital. We investigated the following: (i) validity of visual estimation in the usual clinical setting, (ii) differences in validity according to rater's job categories and tray divisions, and (iii) associations between meal characteristics and validity of visual estimation.

2. Materials and methods

2.1. Data collection

All data were collected from 4 wards (3 general and 1 rehabilitation) of a community hospital in Tokyo, Japan from August to September 2015. The data collection method is shown in Fig. 1. We collected patients' dietary intake data in the usual clinical settings for each tray in the period shortly after eating and before being cleared away in 3 ways: 1) visual estimation by nursing assistants, 2) visual estimation by dietitians, and 3) weighing by researchers.

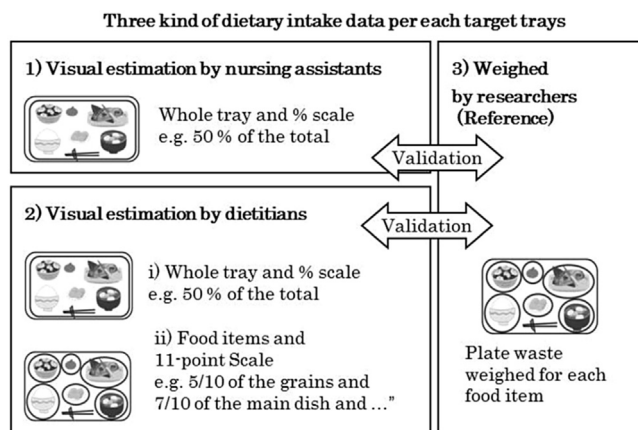


Fig. 1. Data collection method for dietary intake per tray.

Dietitians checked dietary intakes for 2 divisions: (i) whole tray and (ii) food items. Then, we compared the weights and visual estimation data to show criterion validity of visual estimation and characteristics of the trays. A power analysis calculation indicated that for an effect size of 0.2 and power of 0.8, at least 199 trays would be required for comparing the two methods. Cohens' "small" effect size value was based on large standard deviations of previous studies [12].

Approval for the research was granted by Ochanomizu University's Research Ethics Board. All participants (nursing assistants and dietitians) were informed about the aim of the study and signed the consent form. The Research Ethics Board confirmed that we did not need consent from patients who took meals because there was very little burden for patients and patients' treatment information was never used without the dietary intake chart.

2.2. Meal trays

We monitored the hospital lunch menu and chose 15 non-consecutive research days, which had similar menus and allowed correct weighing. Individual food items were grouped by food categories (grains, soup, main dish, side dish, dairy products, and fruits). All research day menus contained grains, a main dish, a side dish, fruits, and dairy. During each research day, uniform menu contents of target trays were served; however, meal texture was adjusted by the patient's swallowing function. In addition, portion sizes were chosen by a doctor from among several standard portions, taking into consideration the patient's age, sex, and appetite. Inclusion criteria for target trays were as follows: 1) regular meals, not therapeutic meals; 2) general, bite-sized, and minced meal textures; and 3) confirmation by the assigned nurse that the patients in receipt of the targeted tray did not have severe medical and psychological problems. Nutrient values of target trays were different for each day and each patient.

2.3. Visual estimation methods

Thirty-four nursing assistants and 4 dietitians evaluated the plate waste of target trays in clinical settings. The raters were not trained in visual estimation in preparation for this research and their usual work. Processes of visual estimation were selected based on the medical staff's routine work and customs. Nursing assistants usually checked whole trays routinely using a percentage scale, which is a method of checking the total intake by gathering all food items. Most of the nursing assistants were accustomed to using an 11-point percentage scale (0%, 10%, 20%, 30%, 40%, 50%,

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