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Preliminary testing using Mokken scaling of an Italian translation of the Edinburgh Feeding Evaluation in Dementia (EdFED-I) scale

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**Running Title: EdFED-I****Authors' names**

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**TITLE: Preliminary testing using Mokken scaling of an Italian translation of the Edinburgh Feeding Evaluation in Dementia (EdFED-I) scale**

**ABSTRACT**

**Purpose**

To study the psychometric properties of an Italian version of the Edinburgh Feeding Evaluation in Dementia (EdFED-I) Scale.

**Background**

The EdFED Scale is the only validated instrument that measures difficulty with feeding in older people with dementia. The original English version of the EdFED had three factors measuring: behavioral aspects of feeding difficulty (obstinacy/passivity); indicators of feeding difficulty; and nursing interventions.

**Methods**

Participants affected by dementia and living in nursing homes (n=210) were selected. Data collectors were trained to observe the residents' eating problems and their food intake. The data were analyzed using Mokken scaling and Pearson's correlation.

**Results**

The Italian version of the EdFED Scale formed a Mokken scale which correlated in the expected direction with measures of residents' weight, Body Mass Index, time taken to eat, Mini Mental State Examination score and Barthel Index according to the unmet needs model of Cohen-Mansfield.

## Conclusions

The EdFED-I shows reasonable psychometric properties and can be used for the assessment of feeding difficulty in Italian samples of older people with dementia. However, further work with larger samples is required to test the utility of the whole range of items and the necessity of their inclusion in the EdFED-I

## Keywords

Construct validity, dementia, EdFED Scale, nutrition, Mokken scaling, item response theory

## INTRODUCTION

### Background

Older people with dementia frequently develop problems around mealtimes and in the later stages of dementia there is an inevitable decline in food intake and an increasing difficulty with self-feeding (Watson, Green, 2006). Difficulty with feeding spans a range of aversive behaviors such as refusal to eat, turning the head away and spitting out food, and, ultimately, an inability to swallow food (Watson, 1996). Associated with feeding difficulty in dementia there is profound weight loss and the sequelae of skin breakdown, muscle wastage and emaciation; low food intake compounds the problem and the outcome is very distressing for family and professional carers and dangerous for the person with dementia.

As recent reviews have shown, there is very little evidence for effective interventions to assist older people with dementia to eat (Watson, Green, 2006) (Liu et al. 2014a). However, there is some evidence that behavioral and educational methods such as spaced retrieval and Montessori methods (Lin et al. 2010) can help older people with dementia to feed themselves better and to increase body mass index. Crucial to any research in this field is the ability to measure feeding

difficulty—i.e. extent and change—and, towards that end, the Edinburgh Feeding Evaluation in Dementia (EdFED) Scale remains the only validated instrument (Aselage et al. 2011). The EdFED scale has been studied in several forms, the original version had 11 items and the factor structure (Watson, 1996) and the scaling properties (Watson, Deary, 1994) of the EdFED scale in English have been analyzed. The EdFED Scale measures patient obstinacy or passivity, nursing intervention and indicators of feeding difficulty (Watson, 1996). Five items related to the behavioral aspects of feeding difficulty in older people with dementia loaded on the obstinacy or passivity factor; however, the most commonly applied version of the EdFED scale focuses solely on patient obstinacy or passivity (with 6 behavioral items in the scale) and these have been shown, using Mokken scaling, to form a hierarchy of items (Watson, 1996). This hierarchy is reasonably stable across different UK samples of older people with dementia and even across cultures (Lin et al. 2008, Liu et al. 2014b), with minor differences that may be explained by different levels of dementia and also due to different levels of training provided to data collectors in different studies. Nevertheless, the hierarchical arrangement of items runs generally from a general refusal to eat through more actively aversive behaviors to letting food fall from the mouth. The EdFED Scale has been successfully used as an outcome measure in intervention studies by Lin et al. (2010), Lin et al. (2011), and Wu et al. (2014).

The version of the EdFED Scale used in the above studies is the 6 behavioral items version; since Mokken scaling was first applied to the EdFED (Watson, 1996), these have been the focus of attention to the exclusion of the remaining items. However, recent work on activity of daily living (ADL) scales demonstrates that, using hierarchical scaling methods, it is worth including a wider range of items to test the predictive ability of a scale (Fieo et al. 2010). In other words, it is worth investigating if there are behaviors or items that can be detected early in a disease process that may indicate subsequent difficulty. For that reason, in the present study, 10 items of the EdFED Scale were included in the analysis. An item of the original EdFED scale, which was a three point

measure of nursing care based on Orem's (1991) model of nursing, included to see if the remaining items correlated with it, was not related specifically to feeding difficulty. Therefore, this item was not included in the original factor analysis and Mokken scaling and is excluded in the present analysis.

### **Mokken scaling**

The present study uses Mokken scaling, the application of which will be described in more detail in the Methods section. Mokken scaling is a method based on item response theory (IRT) (Watson et al. 2012), which uses a series of parameters to evaluate the quality of and the relationship between items in a scale. The unit of analysis in Mokken scaling—in common with other methods of IRT—is the item characteristic curve (ICC). The ICC describes the relationship, in a plot for individual items, between how that item positions respondents on the latent trait (in the present study the latent trait is feeding difficulty) and the probability of obtaining that score (Watson et al. 2012).

Conventionally, Mokken scaling software plots the 'restscore', which is a plot of the total score on the trait minus the item score of interest against the probability of obtaining that score (Stochl et al. 2012), and plots this against the actual score on the item obtained by people scoring the restscore.

However, total scores on the latent trait may also be used (Watson et al. 2015) in place of restscores.

In item response theory an order in the way items are scored is assumed and these methods, therefore, provide a meaningful relationship between the score on a scale and the latent trait that is being measured (Watson et al. 2012). Items in a Mokken scale are ordered in terms of their 'difficulty' and, in this sense, difficulty refers to psychometric difficulty or the likelihood that an item will be endorsed. Items are, therefore, ordered according to their mean scores and, for example, where a high score on an item indicates a greater degree of the latent trait, then those items with a high mean score are more readily endorsed than those with the lower mean score and

the latter are referred to as being more difficult. The utility of a Mokken scale is judged by a range of parameters and these include:

*scalability* ( $H$ ) which is assessed using Loevinger's coefficient ( $H > 0.30$  indicating low but acceptable scalability with  $H > 0.40$  and  $H > 0.50$  indicating a moderate and a strong Mokken scale, respectively) (Watson et al. 2012).  $H$  uses the expected order of items in the scale and violations thereof to assess the unidimensionality of a set of items and  $H$  can be calculated for individual items, item pairs and for the overall scale;

*monotone homogeneity* which is a property of individual items whereby the score on an item increases as the score on the latent trait increases (Watson et al. 2012), in other words, the item characteristic curves (ICCs) are monotone. (Mokken scaling software produces indices indicating violations of monotone homogeneity and the 'Crit' statistic is used to indicate violations of monotonicity (Molenaar et al. 2000). Ideally Crit should be zero but values up to 80 are considered acceptable and this was used in the present study;

*reliability* is measured using Rho and values of  $Rho > 0.7$  are considered acceptable;

*invariant item ordering* (IIO) whereby the order of scoring of items is unaffected by the level of the latent trait being measured (Ligtvoet et al. 2010) and this is assessed using  $H^T$  (analogous to  $H$  above with values of  $H^T > 0.30$ ,  $0.40$  and  $0.50$  indicating weak, moderate and strong IIO, respectively).  $H^T$  is an estimate of the mean distance between the items in a scale. The further apart the items, the greater IIO is likely to be.

More recently, developments in Mokken scaling have enabled standard errors (SE) of  $H$  to be calculated and this includes  $H$  for the total scale ( $H_s$ ),  $H$  for individual items ( $H_i$ ) and  $H$  for item pairs ( $H_{ij}$ ). Calculating SE allows the calculation of confidence intervals (CI) and for scale and item  $H$  these should not include the lowerbound value of 0.30 and for item pairs they should not include 0 (Kuijpers et al. 2013). Little is known about the sample size requirements for Mokken scaling. However, recent simulation work by Straat (2010) shows that one of the factors which

influences sample size are the values of item  $H_i$ . Where  $H_i$  is moderate, sample sizes can be relatively small in the 50 – 250 range but for smaller values of  $H_i$  sample sizes in the thousands may be required.

### **Theoretical framework**

In common with Lin et al. (2008) we used the unmet needs model of Cohen-Mansfield (2000a): ‘The unmet needs model describes how the dementia process results in a decreased ability to meet one’s needs because of a decreased ability to communicate the needs, and a decreased ability to provide for oneself’. Therefore, according to this model, eating needs go unmet as a result of cognitive impairment. This includes inability to communicate hunger and being unaware of the need to eat, and being unable to meet needs related to eating (Cohen-Mansfield 2000b).

## **METHODS**

### **Aim**

The aim of this study was to assess the psychometric properties of the Italian version of the EdFED Scale (EdFED-I). Specifically we investigated: the scalability; monotone homogeneity; reliability; and invariant item ordering.

### **Design**

A survey design was used, with direct observational methods, to obtain data using a series of questionnaires, anthropometric measures and time. The series of questionnaires were the Italian version of the EdFED questionnaire, which was completed by our specially-trained observers, as well as the MMSE, the Barthel Index and the anthropometric measures. Anthropometric measures included height, weight, waist, and hip circumference, which were routinely updated on a monthly basis and included in each patient’s clinical record.



The structure of the EdFED-I was investigated using Mokken scaling and the validity was studied by correlation using a series of measures related to feeding difficulty and dementia, according to the unmet needs model of Cohen-Mansfield (1999):

*The Mini-Mental State Examination (MMSE):* The MMSE was used to evaluate general cognitive functions, including orientation, registration, attention and calculation, recall and language (Folstein et al. 1975). Lower scores on the MMSE mean more impaired cognitive function.

*The Barthel Index:* The Barthel Index was used to measure aspects of daily living as follows: feeding, bathing, grooming, dressing, toileting, transferring, mobility, and use of stairs (Mahoney, Barthel 1965). Lower scores on the Barthel index mean greater impairment in activities of daily living.

*Timing:* mealtime length was measured in minutes by the data collectors using a stopwatch. The start of mealtime was calculated starting from the moment the nurse's aide placed the meal on the table and asked the participant to eat, up to when the participant had either eaten all the food or did not want to eat any more.

*Body weight:* Weighing scales available in the institutions were used to measure the body weight of the participants.

*Body mass index (BMI):* The BMI was calculated as follows: BW (in kilograms) divided by the square of body height (in meters) [BMI = body weight/height<sup>2</sup>].

## **Participants**

Participants were a convenience sample of 211 older people, with a mean age of 83.3 years (SD 7.46); of which 90% (n=189) were female. Participants' characteristics are summarized in Table 1. Our sample included residents from seven nursing homes diagnosed with medium and severe dementia or cognitive impairment, but able to eat on their own, although the consistency of their food was adapted to their ability to chew and swallow. The MMSE was difficult to administer in

these patients because it was necessary to wait when they were more mentally alert and in a good mood. These measurements were repeated every month and reported in the clinical record and this ensured that scores were accurate. However, a comparative analysis of the MMSE between patients with moderate and severe dementia or cognitive impairment did not produce significant results. Moreover, the degree of dementia or cognitive impairment, whether moderate or severe, did not significantly impact on the participants' eating behaviors or difficulties.

### **Data collection**

The study was conducted throughout the month of February 2013. Participants were observed in groups of five or six sitting around a table. For each group, observation was performed during three meals and across two days to check for any significant differences in the time participants took to finish their meals. The observers were three and each one observed a group of participants sitting around a table. Meals were presented to residents on a tray, as delivered by the central kitchen. The relative distance between the resident and observer was set at no less than 2 meters to avoid interrupting or intimidating residents.

The observers were two PhD students and a final year master's degree student who had received prior training. Inter-rater reliability between observers was conducted through parallel observation and through the level of inter-observer agreement, which was over 95%.

This confirmed the good inter-rater agreement levels previously obtained with the original English version of the EdFED questionnaire (Watson et al., 2002).

### **Translation**

The back-translation method was adopted to ensure consistency between the English and the Italian version as follows:

Two native Italian translators, who were also PhD Nursing students with experience the study topic, separately translated the EdFED questionnaire into Italian;

The two Italian versions were then compared and any differences between the two versions were solved following a discussion with the members of our research team;

Then the Italian version was back-translated into English by a native English speaking PhD student, and differences between the translated English version and the original version were discussed and settled directly with the authors of the EdFED scale and the research team, who made the final adjustments to the Italian version.

### **EdFED-I**

The EdFED-I instrument used here consisted of 10 items related to feeding behaviors in older people with dementia. The questionnaire asks the rater to observe the way the patient eats (i.e. 'Does the patient spit out his/her food?' for the response options are: 'never', 'sometimes' or 'often', respectively rated as '0', '1' and '2'). The data did include a question related to Orem's model of needs (1991) but, as explained, these data were not included in the present analysis.

### **Validity and reliability**

All the instruments used in the study have been previously validated, except for the Italian version of the EdFED-I.

### **Data analysis**

Data were entered into SPSS version 20.0 for analysis of descriptive data and correlational analysis. Mokken scaling was carried out using the 'mokken' package in the public domain software 'R' (<http://www.r-project.org/>; accessed 5 March 2014) by importing the EdFED-I scale data in SPSS into R and converting using the 'foreign' package into a format that could be read and analyzed in R (van der Ark 2007). The resulting Mokken scale was identified using the automatic item selection procedure in R and ICCs of item pairs were plotted to ensure that there was minimal overlap and that further analysis could proceed.

The scale was then further analyzed by testing for scalability of items, reliability of the scale and IIO. In addition, using the standard errors of the Loevinger's coefficients, the 95% confidence intervals (CIs) for  $H_i$  and  $H_{ij}$  were calculated.

## Ethics

Permission to conduct the study was obtained from the Ethics Committee of the University of Genoa. In collaboration with the nursing home administration, family members were contacted and signed a consent form that had received prior approval by the Ethics Committee of the University of Genoa

## RESULTS

Table 2 shows the outcome of the Mokken scaling analysis. The first column shows the items, with their item numbers from the EdFED scale order in terms of their item difficulty according to their mean score. The easiest item—i.e. the one that was most commonly observed—is ‘Does the patient require close supervision while feeding?’ and the most difficult item is ‘Does the patient spit out his/her food?’ The next column shows the scalability coefficients  $H$  for each of the items with their 95% confidence intervals in brackets. All ten items were retained in the scale because all of the items had scalability coefficients greater than the lowerbound limit of 0.30 and the overall scale has  $H=0.42$  indicating a moderate Mokken scale; 95% CIs for all  $H_{ij}$  were acceptable and no items were removed from the scale on the basis of violating monotonicity. The majority of the 95% CIs for  $H_i$  included the lowerbound value of 0.3; however, there is some evidence that this may be sample size dependent requiring very large samples to be acceptable (Watson et al. 2015), therefore, these items were not excluded from the present study. The scale has reliability  $Rho=0.83$  and shows

moderate IIO ( $H^T=0.41$ ). The items run, in terms of difficulty, from requiring help and indications of feeding difficulty through refusal to eat and swallow and then, at the most difficult level, letting food fall out of the mouth and spitting food out.

Inspection of ICCs (Figure 1) showed that the items related to nursing intervention (e.g. supervision) overlapped (Figure 1a) and items related to indicators of feeding difficulty (e.g. leaving food on a plate) were very close together (Figure 1b). Items related to nursing care and behavioral aspects were far apart (Figure 1c) while some of the obstinacy or passivity items were very close (Figure 1). Recent work (Meijer, Egberink 2012) has indicated caution when Mokken scaling parameters such as  $H^T$  are high.  $H^T$  is merely a measure of the mean distance between items meaning that single items or clusters of items positioned far from other items or clusters of items can lead to misinterpretation; i.e. that IIO is present when, in reality, it is not. Therefore, based on the observations exemplified in Figure 1, two further steps were taken whereby the items related to nursing intervention items and those related to indicators of feeding difficulty were consecutively removed and the effect on IIO observed. These steps lowered  $H^T$  to 0.23 for both scales, suggesting that these clusters of items were artificially inflating  $H^T$ ; the scale  $H$  remained at  $H=0.42$ .

Table 2 shows the intercorrelations of the EdFED-I 10-item scale and the EdFED-I 6-item scale scores with the related measures of cognitive function and nutrition. Both forms of the EdFED-I Scale correlate in the expected direction with all these measures, i.e. negatively with the MMSE, the Barthel index, weight and BMI but positively with time taken to eat. Most of the correlations are statistically significant but, taking a Bonferroni correction into account for multiple measures, the negative correlation between the 10-item EdFED-I score and the BMI was not significant. Also, the negative correlations between the 6-item EdFED-I MMSE and BMI were not significant.

## DISCUSSION

The present study set out to study the psychometric properties of an Italian translation of the EdFED Scale. Specifically, it used Mokken scaling and concurrent validation to see if the scaling properties of the EdFED—established in previous studies—held for the Italian translation and if insight into the construct validity of the scale could be gained by correlation with a series of measures that could be expected to be related to the level of feeding difficulty such as cognitive status, activities of daily living and body weight.

On the basis of early studies on the development of the EdFED Scale, where factor analysis suggested a set of five behavioral items which could be used to measure feeding difficulty directly (Watson, Deary 1994) and which was supported by the early Mokken scaling analysis of the EdFED where the analysis also isolated these same items and included a 6th behavioral item, the remaining items have largely been treated separately in subsequent scaling studies. However, in the present study ten items of the EdFED-I were entered into Mokken scaling to see if the feeding behaviors were related to the other nursing interventions and indicator items and to see if these were predictors for feeding difficulty. The rationale was based on recent analysis of the Townsend Activities of Daily Living scale (Fieo et al. 2010) where a case was made for such predictive power of certain items. The resulting rationale is that it may be possible to inaugurate interventions for feeding difficulty earlier in dementia and the imperative for this comes from a line of successful work into feeding difficulty in dementia (Lin et al. 2010).

All ten EdFED-I items were retained in a Mokken scale and the order of difficulty ran from items referring to nursing intervention through indicators of feeding difficulty to those referring to the behavioral/volitional aspects of feeding difficulty. The order of difficulty of the latter set of items is similar to the order of items in the original EdFED Scale and subsequent analyses (Lin et al. 2008) (Liu et al. 2014a); in fact, for five of the 6 items, it is identical with the exception of one item (Does the patient spit out his/her food?) which is at the most difficult end of the EdFED-I as

opposed to being in the lower half of difficulty in the original EdFED Scale. The overall scale showed acceptable scaling and mean distance between items as estimated by  $H^T$ . However, on the basis of recent work (Meijer, Egberink 2012) we decided to look at the ICC pair plots, not only for evidence of intersection—this was minimal and supported by the CIs for item pairs—but for evidence of ICCs which were at a distance from the others. There was evidence that the nursing intervention items, especially, were far removed from the behavioral items and that the indicators of feeding difficulty items were, likewise, at a distance, although closer to the behavioral items. Removing these items from the analysis of IIO lowered the mean distance between items to indicate weak IIO when the nursing intervention items were removed and slightly lower again when the indicators of feeding difficulty items were removed. In fact, the level of IIO of the behavioral items is very close to that observed in a previous study (Watson et al. 2012). Therefore, the high level of IIO indicated in the ten-item scale may be largely accounted for by the nursing intervention items and this is compounded by the fact that the behavioral items were very close together. Nevertheless, despite the closeness of the behavioral items and the low level of IIO shown on removal of the nursing intervention items, none of the 95% confidence intervals of all ten EdFED-I item pairs indicated that these should be removed. Some of the 95% confidence intervals for individual items included the lowerbound value of 0.30 but none were removed as the sample size was probably quite small for this particular measure. The consequences of having a scale with acceptable scale  $H$  but low IIO means that the scale is suitable for ordering individuals on the basis of their mean score on the EdFED-I but that the ordering of items for individuals may not be the same at all levels of the latent trait of difficulty with feeding. Specifically, individuals with low levels of feeding difficulty may not score items in precisely the same order as individuals with high levels of feeding difficulty.

Criterion validation in this study showed that the EdFED-I behaves as expected in both the 10-item and the 6-item versions: with lower cognitive status the score on the EdFED-I increases; with decreasing ability in activities of daily living the EdFED-I score increases; time taken to feed

increases with increasing EdFED-I score; and weight and BMI are inversely related to EdFED-I score. The exceptions were the relationship between the 6-item EdFED-I score and MMSE and BMI, which, while negatively correlated, were not statistically significant; also the negative correlation between the 10-item EdFED-I and BMI was not statistically significant. This may be a sample-dependent outcome as larger samples tend to produce significant correlations.

In summary, it appears that, there is no additional predictive power in the EdFED-I as a result of including 10 as opposed to just 6 items; the 10-item version and the 6-item versions work equally well on the basis of their correlation with related measures of cognitive status and nutritional status. However, on the basis of the present Mokken scaling analysis and taking into account that there is some clustering of items at different levels of the EdFED-I scale, it appears that the four items indicating feeding difficulty and the need for nursing assistance with feeding lie on a continuum with the 6 items measuring obstinacy or passivity. Further work with a larger sample may be required to differentiate further the utility of the 6 and ten item versions.

### **Limitations**

The main limitation of the present study is that the sample size is small, especially in the light of recent work on sample size requirements for Mokken scaling (Straat, 2010). Another limitation may be that the mean values for all the feeding difficulty items were low due to the preponderance of participants with low levels of feeding difficulty; therefore, in the present study we were not measuring feeding difficulty across the whole range of the trait from low to high levels of feeding difficulty.



## **Conclusion**

There is evidence here that the EdFED-I may be a useful instrument to measure feeding difficulty in older people with dementia in the Italian population. There is additional evidence that there may be predictive power in the items not related to the behavioral aspects of feeding difficulty and that these may well be included in future Mokken scales. Future work requires a larger sample and a more even spread of feeding difficulty within that sample.

## **Significance of the study and application to nursing**

The significance of this study is that a new translation of the EdFED scale has been produced and an initial study of its psychometric properties shows promising results. The application to nursing is that feeding patients who are unable to feed themselves or who have difficulty with feeding is clearly in the domain of nursing practice and assessment of feeding difficulty is the first step towards appropriate intervention.

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**Figure 1. Examples of item characteristic pair plots of EdFED**

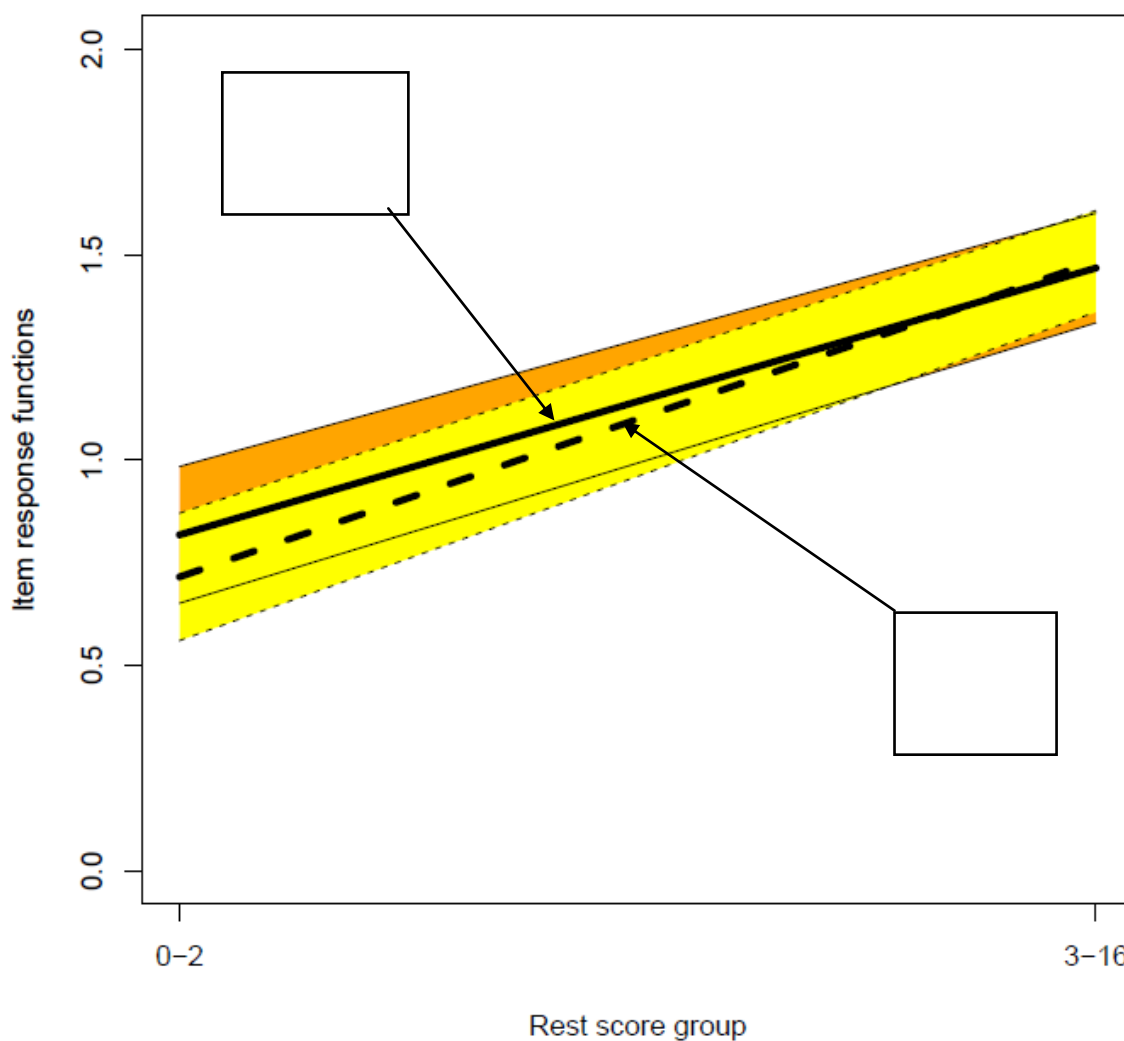
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**Figure 1a Item pair plots for ‘Does the patient require close supervision while feeding?’ and ‘Does the patient require physical help with feeding?’**

Legend:

Bold black line = Supervision

Bold dotted black line = Physical help

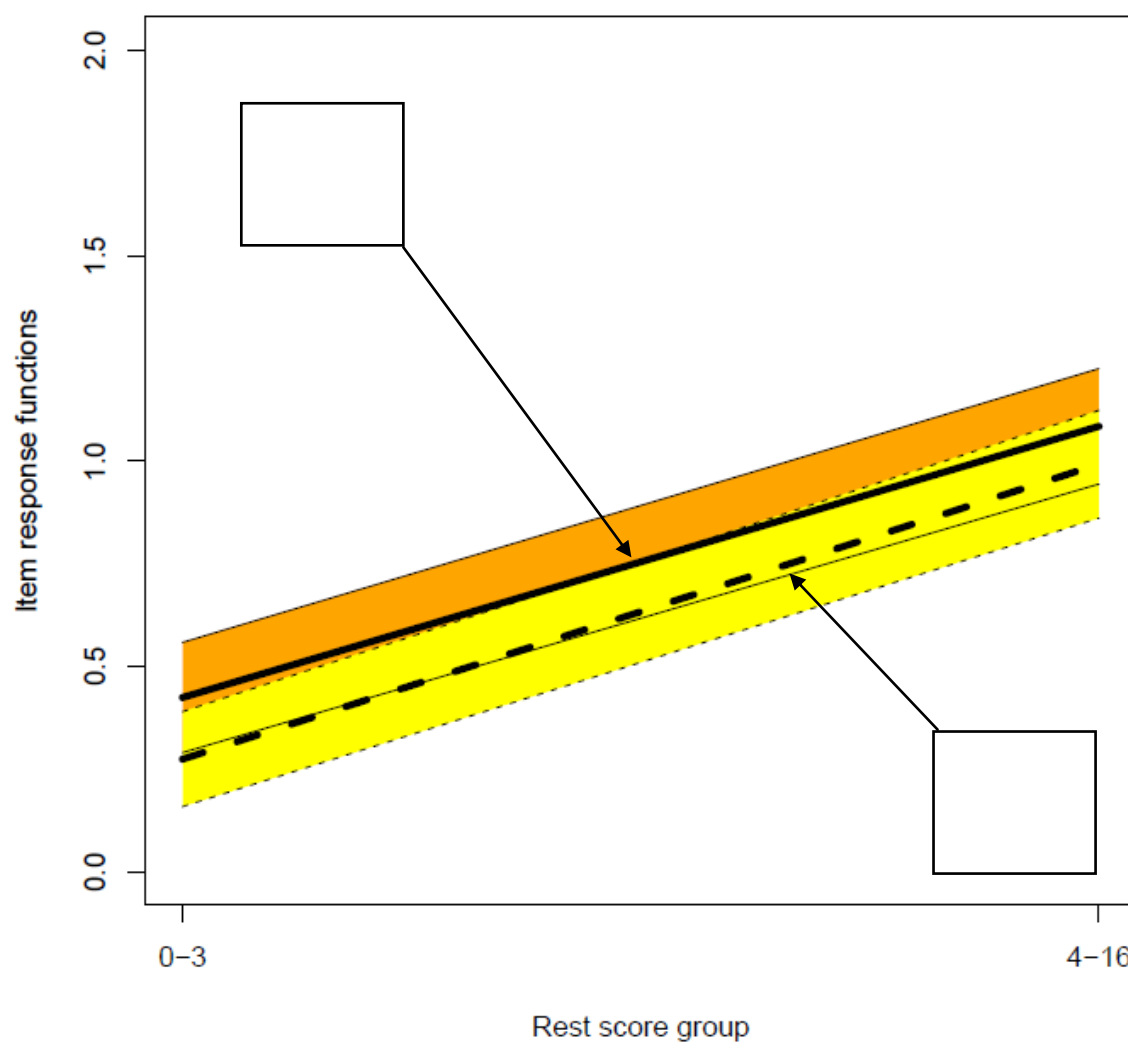


**Figure 1b Item pair plots for ‘Does the patient tend to leave food on the plate at the end of a meal?’ and ‘Is there spillage while feeding?’**

Legend:

Bold black line = Leave food on plate

Bold dotted black line = Spillage



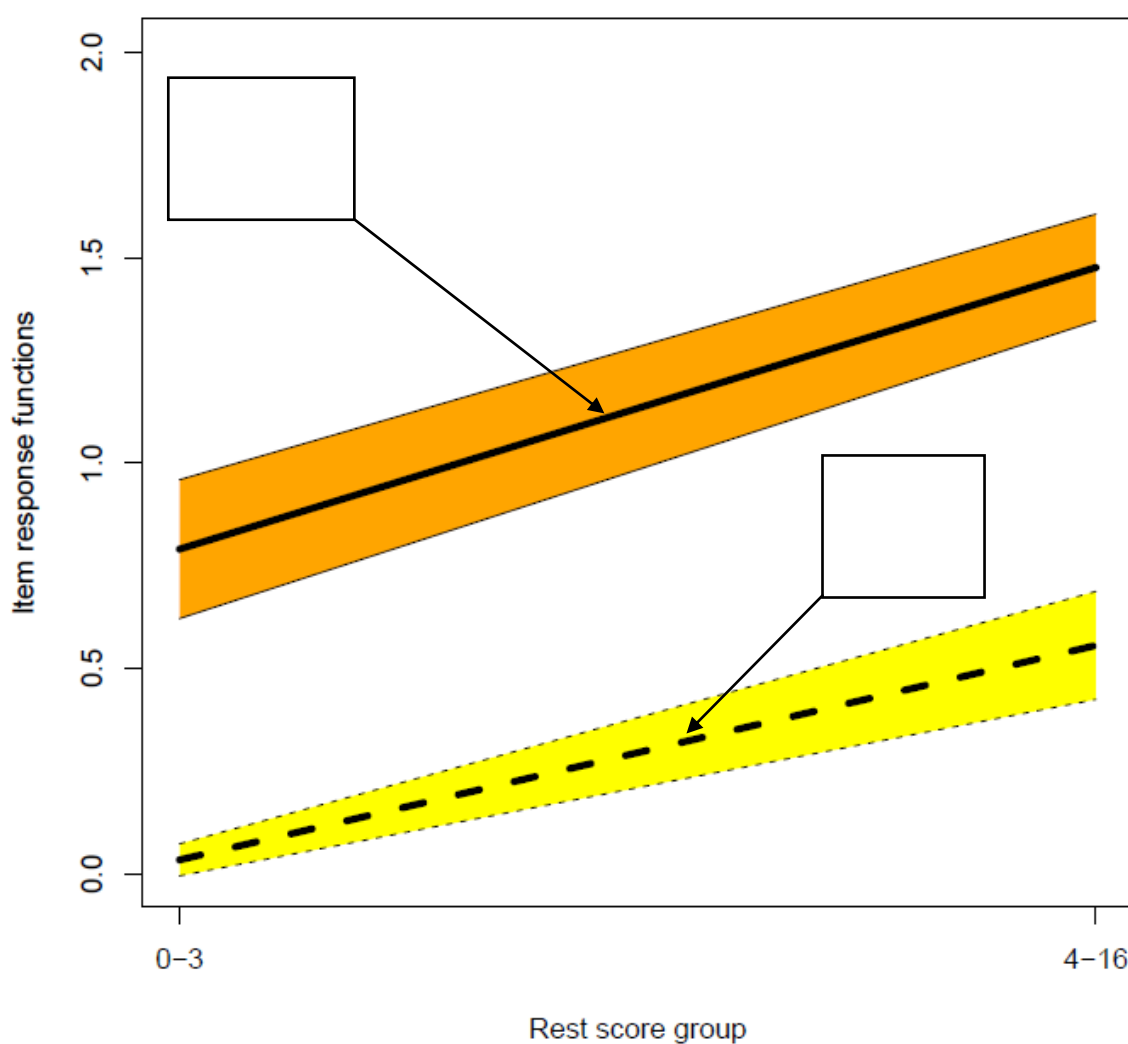


**Figure 1c Item pair plots for ‘Does the patient require close supervision while feeding?’ and ‘Does the patient turn his head away while being fed?’**

Legend:

Bold black line = Supervision

Bold dotted black line = Turning head away

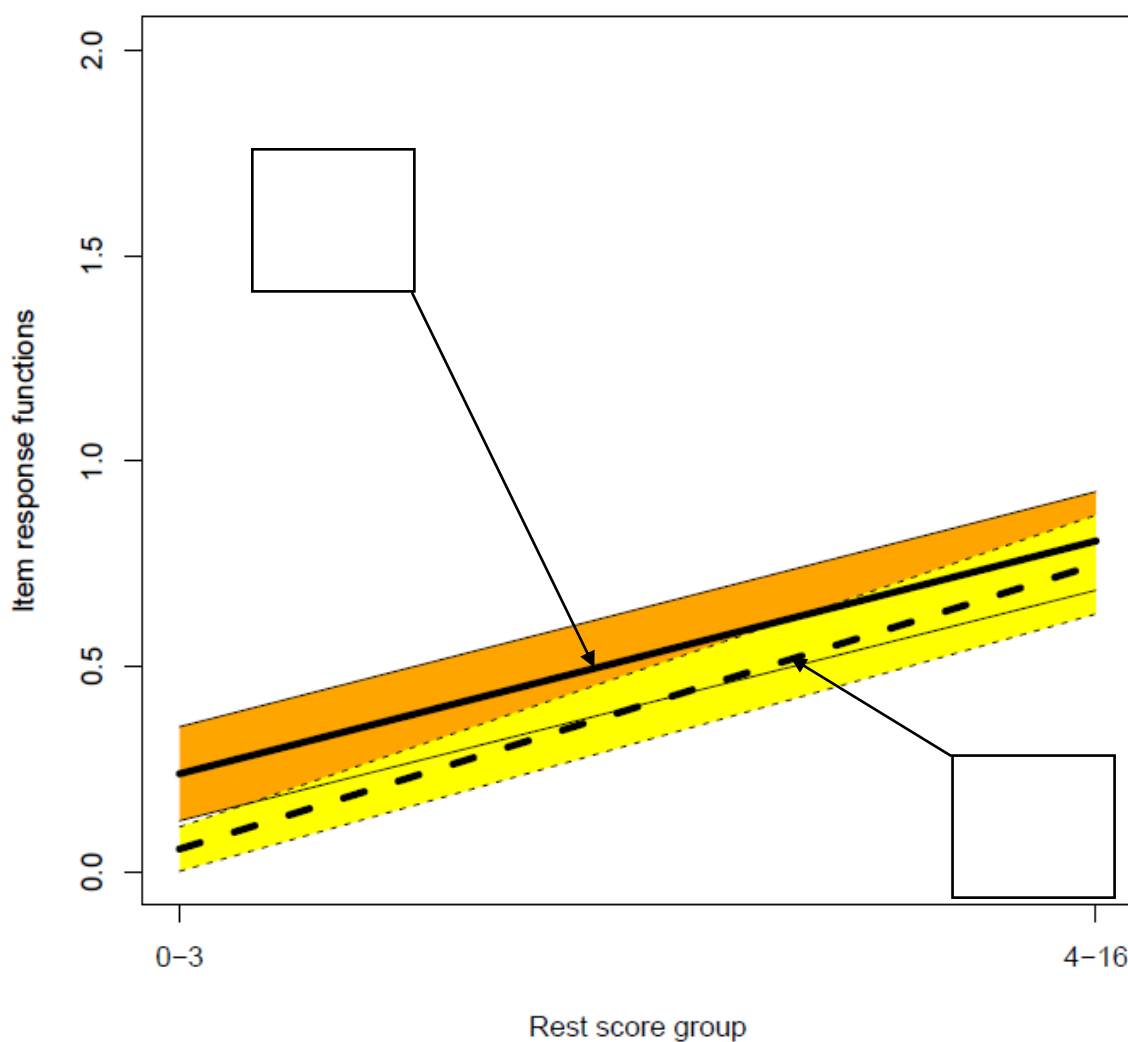


**Figure 1d Item pair plots for ‘Does the patient ever refuse to eat?’ and ‘Does the patient refuse to open his mouth?’**

Legend:

Bold black line = Refuse to eat

Bold dotted black line = Refuse to open mouth



**Table 1 Descriptive data for participants**

<u>Parameter</u>	<u>Range</u>	<u>Mean (SD)</u>
MMSE	0-28	11.2 (6.58)
Barthel	0-95	29.2 (25.41)
Time to eat (minutes)	5-40	14.1 (4.80)
Weight (kg)	29-98	57.7 (12.83)
BMI	17.5-37	21.7 (4.45)

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**Table 2****Mokken scaling analysis of the Italian version of the EdFED-I Scale (10-items)**

<u>Item</u>	<u>Mean</u>	<u>Hi (95% confidence intervals)</u>
1. Does the patient require close supervision while feeding?	1.20	0.40 (0.29-0.51) <sup>†</sup>
2. Does the patient require physical help with feeding?	1.16	0.48 (0.38-0.58)
4. Does the patient tend to leave food on the plate at the end of a meal?	0.83	0.37 (0.27-0.47) <sup>†</sup>
3. Is there spillage while feeding?	0.72	0.38 (0.28-0.48) <sup>†</sup>
5. Does the patient ever refuse to eat?	0.61	0.42 (0.33-0.51)*
7. Does the patient ever refuse to open his/her mouth?	0.51	0.50 (0.41-0.59)*
10. Does the patient refuse to swallow?	0.36	0.48 (0.38-0.58)*
6. Does the patient turn his/her head away while being fed?	0.34	0.45 (0.36-0.54)*
9. Does the patient leave his/her mouth open allowing food to drop out?	0.32	0.35 (0.23-0.47) <sup>†*</sup>
8. Does the patient spit out his/her food?	0.28	0.37 (0.25-0.49) <sup>†*</sup>

H = Loevinger's coefficient; Hi = item H; Scale H = 0.42;  $H^T = 0.41$ ; Rho = 0.89; \*- items belonging to the 6-item EdFED-I; †=items where CI includes the lowerbound value of 0.30

**Table 3**

**Correlations (p-value) between EdFED-I (10-items) and EdFED-I (6-items) total score and Mini-Mental State Examination (MMSE), Barthel Index (Barthel); time taken to eat (Time), weight (Weight) and Body Mass Index (BMI) (n=165)**

	<u>MMSE</u>	<u>Barthel</u>	<u>Time</u>	<u>Weight</u>	<u>BMI</u>
EdFED-I (10-item)	-0.21 (0.002)	-0.32 (<0.001)	0.39 (<0.001)	-0.23 (<0.001)	-0.15 (0.025)
EdFED-I (6-item)	-0.12 (0.074)	-0.19 (<0.005)	0.32 (<0.001)	-0.21 (0.002)	-0.11 (0.097)
MMSE		0.27 (<0.001)	-0.13 (0.104)	0.09 (0.104)	0.14 (0.047)
Barthel			-0.23 (0.001)	-0.05 (0.756)	-0.04 (0.548)
Time				-0.15 (0.031)	-0.05 (0.510)
Weight					0.80 (<0.001)