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## Use of the McGill Ingestive Skills Assessment for Assessing Feeding of Neurological Patients in Slovenia

**Abstract.** There is a lack of feeding-assessments tools for neurological patients in Slovenia. The purpose of the study was to explore the use of the McGill Ingestive Skills Assessment (MISA) in occupational therapy of patients with neurological impairments. Eighty-one adult patients were included in the study: 27 rehabilitation inpatients and 54 from a residential program for the elderly. Patients with dementia scored the lowest on average (56 % of the maximum possible score). Positioning received the lowest average score among feeding categories (48 %). The difference in the average score between the two patient groups was statistically significant, whereby rehabilitation inpatients scored higher on average by 15 %. Positioning was statistically significantly positively associated with other areas of feeding (ability to self-feed, ingestion of liquid and solid foods, texture management of liquid and solid foods). The patients' ability to eat independently therefore seems to be affected by their diagnosis as well as the type of health-care setting. Positioning appears to play a crucial role in achieving independence with feeding. The MISA is a promising assessment tool for neurological patients in Slovenia.

## Uporaba vprašalnika McGill za ocenjevanje hranjenja pri nevroloških bolnikih v Sloveniji

**Povzetek.** V slovenskem prostoru primanjkuje ocenjevalnih orodij s področja hranjenja za nevrološke paciente. V raziskavi smo želeli raziskati uporabnost vprašalnika McGill v delovni terapiji pacientov z nevrološkim okvarami. Sodelovalo je 81 pacientov: 27 pacientov na bolnišnični rehabilitaciji in 54 pacientov iz programa dnevne oskrbe starejših. Najslabše rezultate so v povprečju dosegli pacienti z demenco (56% možnih točk). Med ocenjevanimi področji je bil dosežek v povprečju najnižji za položaj pri hranjenju (46 %). Skupini pacientov sta se med seboj statistično značilno razlikovali, pri čemer so pacienti na bolnišnični rehabilitaciji v povprečju dosegli 15 % možnih točk manj. Položaj pri hranjenju je bil statistično značilno pozitivno povezan z drugimi ocenjevanimi področji (možnost samostojnega hranjenja, vnos tekoče in trdne hrane, obvladovanje teksture tekoče in trdne hrane). Zmožnost pacientov za samostojno hranjenje se je torej pokazala kot odvisna od diagnoze in okolja. Zdi se, da ima položaj pri hranjenju ključno vlogo pri zmožnosti samostojnega hranjenja. Vprašalnik McGill je obetavno orodje za ocenjevanje nevroloških pacientov v Sloveniji.

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## Introduction

Neurological disorders often happen suddenly and unexpectedly and can affect different areas of human performance, including the ability to feed oneself.<sup>1</sup> However, different neurological conditions – such as cerebrovascular accident (CVA), traumatic brain injury (TBI), dementia, Parkinson's disease and multiple sclerosis – all present differently, so the patients' level of independence with feeding also varies.<sup>2</sup>

Feeding is one of the basic physiological needs and has to be fulfilled in order to survive.<sup>3</sup> The most important factors that influence feeding include correct and uninterrupted function of facial and chewing muscles, muscles of the pharynx and trunk stabilising muscles, surface sensibility of the oral cavity, healthy teeth, sufficient production of saliva, good function of the tongue, a normal swallowing reflex and intact epiglottis function.<sup>4</sup> The positioning of the trunk (the core of the body) importantly influences these factors and can either facilitate or inhibit movements and tasks connected with feeding. Correct positioning can often enable easier food swallowing by providing trunk stability and the aligning of the head and neck during the process of feeding.<sup>5</sup> The position of the feet, legs and the pelvis also influence core stability, while the position and muscular activity of the head and neck influence movements of the jaw. In turn, good jaw stability and ease of movement affect the lips and tongue control.<sup>6</sup>

For patients with neurological disorders, feeding assessments are a part of the functional assessment and can be a marker of progress of the treatment or rehabilitation process. Such assessments provide information on safety, efficacy and the need for assistance with feeding.<sup>7</sup> During therapy, progress in the area of feeding can sometimes be minimal. In contrast, some patients can significantly improve their ability to position themselves, bring food to the mouth and swallow, thus improving their overall independence with feeding. Every new skill that can contribute to more independent eating can therefore be considered as progress. Furthermore, due to its basic nature, independence with feeding often presents an important rehabilitation goal on its own.<sup>2</sup>

Several assessment instruments for feeding are currently in use worldwide. They evaluate different aspects of feeding, for example the ability to swallow,<sup>8</sup> independence with feeding,<sup>9</sup> the motor function of facial muscles,<sup>10</sup> aspiration risks,<sup>11</sup> and positioning.<sup>12</sup> It is important, however, to make a comprehensive

assessment that addresses different stages and parts of the feeding process at the same time. The McGill Ingestive Skills Assessment (MISA) has been recognised as a holistic method of feeding evaluation. It focuses on the user's ability to ingest food and fluids of different consistencies in a safe and independent manner.<sup>13,14</sup> It was developed in Canada in 2003 and has since been used in several European countries, but not in Slovenia. In our country, the most commonly used feeding assessment instrument is the Dysphagia Disorder Survey (DDS), which is a standardised screening and clinical evaluation for feeding and swallowing disorders in children and adults with developmental disabilities.<sup>15</sup> The DDS might therefore not suffice for functional assessment of feeding in adults and older people.<sup>13</sup>

Hence, the purpose of our pilot study was to demonstrate the feasibility of the MISA in Slovenia by examining differences in feeding between patients with various neurological disorders undergoing occupational therapy in two different institutions. We put particular emphasis on the importance of positioning in feeding.

## Methods

### Participants

Eighty-one patients with neurological disorders participated in the study: 22 were included in the inpatient rehabilitation program at the University Rehabilitation Institute in Ljubljana (URI) and 59 in daily programs at the Centre for Blind, Partially Sighted and Older People in Škofja Loka. The data were collected in the period from May 1<sup>st</sup>, 2017 to June 20<sup>th</sup>, 2017. The patients' diagnoses included stroke, Alzheimer's disease, Parkinson's disease, traumatic brain injury (TBI), multiple sclerosis and other neurological conditions.

The inclusion criteria for participation were: age 18 years or more, neurological disorder, no major cognitive impairment, ability to consume food orally and observable difficulty with feeding (i.e. difficulty adopting a good position for feeding, difficulty swallowing, difficulty keeping food in the mouth or need for consistency modifications of food, such as pureed food, fork-mashable food or thickened liquids). Participation was voluntary. All the participants were given oral and written information about the study and they could withdraw their consent at any point without consequences. Ethical clearance was obtained from the Medical Ethics Committee of the URI (motion no. 15/2017)

**Table 1** Mean McGill Ingestive Skills Assessment scores (raw and relative, i.e., proportion of maximum possible score) according to the diagnosis.

Scale (maximum no. of points)	Stroke ( <i>n</i> = 30)	Alzheimer's Disease ( <i>n</i> = 20)	Traumatic brain injury ( <i>n</i> = 13)	Parkinson's disease ( <i>n</i> = 6)	Multiple sclerosis ( <i>n</i> = 4)	Other diagnoses ( <i>n</i> = 8)	Total sample ( <i>N</i> = 81)
Positioning (12)	5.7 (48 %)	4.8 (40 %)	6.8 (57 %)	6.5 (54 %)	6.3 (52.5 %)	5.9 (49 %)	5.8 (48 %)
Self-Feeding (21)	13.3 (63 %)	9.7 (46 %)	14.5 (69 %)	13.7 (65 %)	12.0 (57.1 %)	14.5 (69 %)	12.7 (60 %)
Liquid Ingestion (21)	13.7 (65 %)	12.2 (58 %)	16.0 (76 %)	15.8 (75 %)	17.5 (83.3 %)	15.8 (75 %)	14.2 (68 %)
Solid Ingestion (36)	25.9 (72 %)	22.9 (64 %)	28.8 (80 %)	28.3 (79 %)	27.5 (76.4 %)	30.3 (84 %)	26.3 (73 %)
Texture Management of Liquids (15)	10.7 (71 %)	9.9 (66 %)	13.4 (89 %)	12.8 (85 %)	12.0 (80.0 %)	13.3 (89 %)	11.4 (76 %)
Texture Management of Solids (24)	15.3 (64 %)	13.0 (54 %)	20.5 (85 %)	19.7 (82 %)	18.5 (77.1 %)	20.8 (87 %)	16.6 (69 %)
Total score (129)	84.5 (66 %)	72.2 (56 %)	99.9 (77 %)	96.8 (75 %)	93.8 (73 %)	100.4 (78 %)	86.9 (67 %)

### Assessment

The MISA was used for data collection. It comprises 43 items, which are divided into six categories that are scored as subscales: Positioning, Self-Feeding Skills, Solid Ingestion, Liquid Ingestion, Texture Management of Liquids, and Texture Management of Solids. A 3-point ordinal scale is used for each item (1 = never or rarely, 2 = sometimes, 3 = always or almost always). Hence, the maximum total score is 129 points and the minimum is 43 points. A higher score indicates a better ability to eat independently. The categories contain from 4 (Positioning) to 12 items (Solid Ingestion).<sup>14</sup> Psychometric properties of the MISA are considered adequate for treatment planning.<sup>13</sup> For the purpose of our study, we translated the original instrument into Slovenian (and verified the translation by backward translation).

The participants were observed during lunch or dinner (each participant was observed once). The MISA was completed in real-time by the first two authors (occupational therapists, trained in the field of eating disorders), half of the participants each. They did not physically intervene during the feeding process.

### Data Analysis

Mann-Whitney test was used to compare the MISA scores between the two institutions. Kruskal-Wallis test was used to compare the scores between diagnostic groups. Friedman test was used to compare mean item score between the subscales in the pooled sample. Spearman and Pearson correlations were computed to assess association between subscale

scores. No correction for multiple testing was applied. Statistical analyses were performed using IBM SPSS Statistics 23 (IBM Corp., Armonk, USA).

### Results

The majority of the participants were women (59 %). The most frequent diagnosis was stroke (37 %), followed by Alzheimer's disease (25 %), TBI (16 %), Parkinson's disease (7 %) and multiple sclerosis (5 %); 10 % of the participants had other diagnoses.

Mean MISA scores (raw and relative, i.e., proportion of maximum possible score) according to the diagnosis are reported in Table 1. The mean item score differed statistically significantly between the subscales ( $p < 0.001$ ). On average, Positioning received the lowest score (48 % of the maximum possible score) and Texture Management of Liquids the highest (76 %). Patients with different diagnoses had statistically significantly different total and subscale scores ( $p$  from 0.001 to 0.026; except for Positioning,  $p = 0.086$ ). Apart from the mixed group of other diagnoses, the patients with dementia caused by Alzheimer's disease had the lowest total score on average (56 %), while those with TBI scored the highest (77 %). The average total score of the whole sample was 67 %.

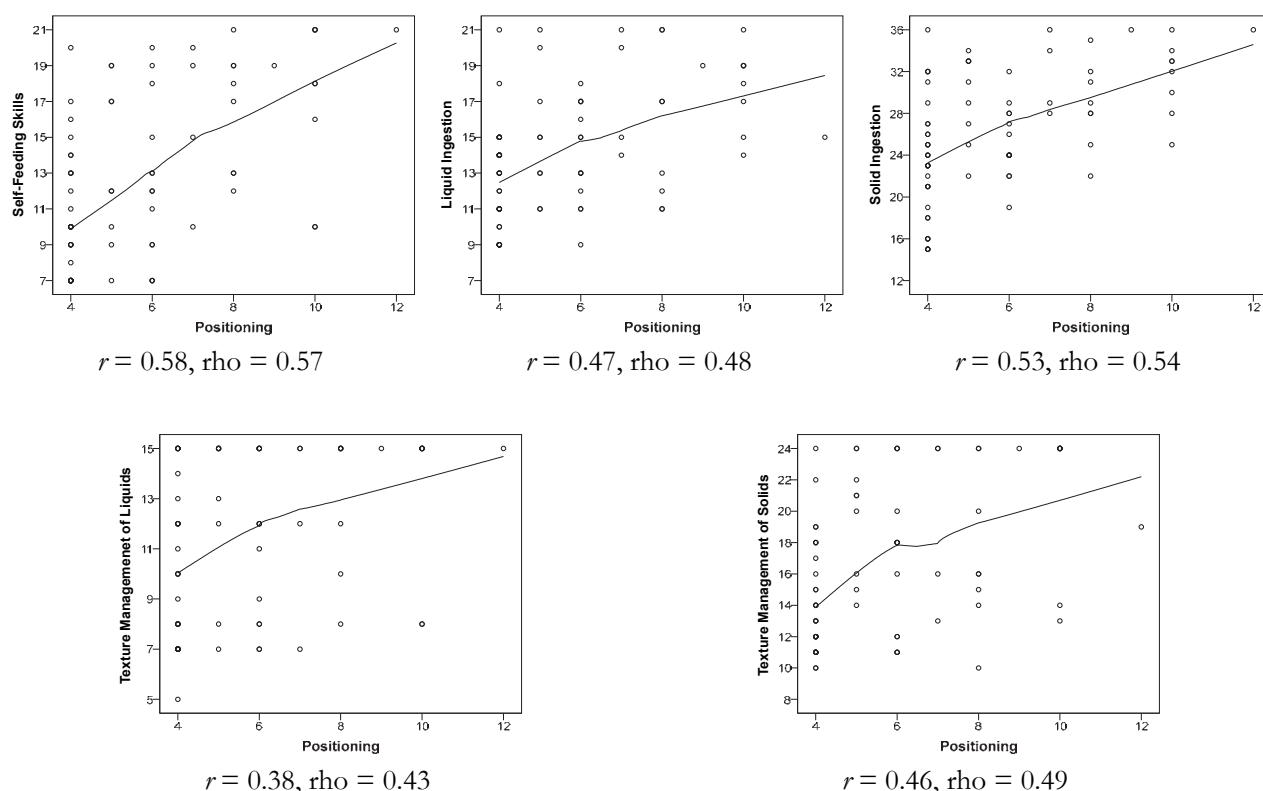
Comparisons between the two institutions are summarised in Table 2. The relative difference in the mean MISA total score between the inpatient rehabilitation group and the residential program group was 15 % ( $p < 0.001$ ). The largest relative difference in the mean score between the two institutions was observed for the Texture

Management of Solids subscale (27 %,  $p < 0.001$ ). Even on the subscale with the smallest relative mean difference, the two institutions still differed statistically significantly (Positioning, 7 %,  $p = 0.036$ ).

Positioning was statistically significantly positively associated with other areas of feeding (Figure 1). The strength of the associations was moderate. The similarity of the Spearman and Pearson correlation, as well as the shape of the fitted LOESS curves, indicate that the associations were approximately linear.

**Table 2** Comparisons of McGill Ingestive Skills Assessment scores between the two institutions.

Scale (maximum no. of points)	Residential programs (n = 59)		Inpatient rehabilitation (n = 22)		Relative mean difference	p (Mann-Whitney test)
	Mean (%)	Range (SD)	Mean (%)	Range (SD)		
Positioning (12)	6.3 (53 %)	4–10 (2.0)	5.5 (46 %)	4–12 (2.1)	7 %	0.036
Self-Feeding (21)	14.1 (67 %)	9–20 (3.7)	12.1 (58 %)	7–21 (5.0)	10 %	0.057
Liquid Ingestion (21)	16.5 (79 %)	11–21 (3.4)	13.4 (64 %)	9–21 (3.1)	15 %	0.001
Solid Ingestion (36)	29.6 (82 %)	18–36 (4.9)	25.0 (69%)	15–36 (5.6)	13 %	0.001
Texture Management of Liquids (15)	13.4 (89 %)	7–15 (2.8)	10.6 (71 %)	5–15 (3.3)	19 %	0.001
Texture Management of Solids (24)	21.2 (88 %)	15–24 (3.1)	14.8 (62 %)	10–24 (4.3)	27 %	<0.001
Total score (129)	101.7 (78 %)	69–122 (16.3)	81.6 (63 %)	53–125 (19.2)	15 %	<0.001



**Figure 1** Association of Positioning score with other subscale scores of the McGill Ingestive Skills Assessment in 81 neurological patients (scatterplots with LOESS fit using Epanechnikov kernel; Spearman and Pearson correlation are listed below each scatterplot, all  $p$ -values < 0.001).

## Discussion

Like the original MISA study,<sup>13</sup> our study indicated that instrument appropriate for patients with various neurological conditions. This supports the use of the MISA in inpatient as well as in residential setting, thus facilitating different phases of the rehabilitation process.

Our results indicate that the ability to feed oneself varies between different neurological conditions. The lowest average overall score was recorded for patients with dementia who are suffering from degenerative changes of the neurological system, which also affect the feeding coordination and the ability to eat independently.<sup>16</sup> Apart from the mixed group of patients with other diagnoses, the patients after TBI scored the highest on average. Large variability has been observed in feeding ability of the population of patients after TBI, depending on which part of the brain has been affected by the trauma.<sup>17</sup> The relatively high scores that we observed could also be explained by the rehabilitation phase. The majority of the patients after TBI in our study have namely already re-learned the skills connected with feeding during they stay at the URI, so their feeding difficulties were less pronounced.

We also observed differences between different categories of the MISA, which reflect different areas of feeding. The maximum relative difference between subscale scores was 28 %. Positioning had the lowest average score and texture management of fluids the highest. This is not surprising because people with neurological impairments often experience lower muscular tonus of the abdominal muscles, which affects positioning during feeding and makes object manipulation harder.

Our findings indicate that the type of health-care institution where the patients receive treatment can influence their feeding-assessment results. The rehabilitation inpatients scored higher on average than the patients in residential care. As already mentioned, the aim of the rehabilitation program is for patients to relearn lost skills, while the focus in the residential setting is on skill preservation. The difference was the largest for the Texture Management of Solids category. The reason could be that most patients in the rehabilitation program can bring food to the mouth and swallow it, whereas those in the residential setting program were often not able to eat independently any more.

On average, Positioning received the lowest score in both settings. The difference from the other MISA

subscales was the most pronounced in patients with dementia and those after stroke. Dementia is associated with a wide range of symptoms because of the decline in memory and other cognitive abilities, which can be severe enough to reduce the person's ability to perform such basic daily activities as feeding.<sup>18</sup> The patients after stroke often experience paralysis of one half of the body, which affects positioning during feeding.<sup>19</sup>

Our results showed that positioning clearly positively correlated with other aspects of feeding. The central of body positioning for feeding and its influence on independent food intake and swallowing has been noted in previous studies.<sup>6,18</sup> This suggests that better positioning of a patient with a neurological disorder can contribute to his or her better independence with feeding. Occupational therapists can also assist the patients with other aspects of feeding. In addition to positioning, their interventions can involve environmental modifications, use of adaptive equipment, feeding and swallowing strategies and remediation techniques.<sup>20,21</sup>

Despite meeting its main goals, our study had several limitations. Time constraints limited the sample size, especially for the rehabilitation inpatients. Data on the participants' age was not collected, so no comparisons between age groups or adjustment of score differences for age could be made. Future studies should include a larger sample, address various types of reliability (inter-rater, retest) and validity (internal – by means of factor analysis or item-response theory, and concurrent – for example in comparison with scores from assessments of activities of daily living). The impact of cognitive decline on feeding could also be estimated by using an appropriate mental-ability test.

## Conclusion

Our study was the first documented application of the MISA in Slovenia. We observed differences in feeding between patients with different diagnoses, as well as between patients undergoing inpatient rehabilitation and those in a daily program in residential care. The importance of positioning in feeding was confirmed. Our findings suggest that the expertise of occupational therapists could help neurological patients to improve their independence with feeding. Further research should be carried out to comprehensively assess psychometric properties of the Slovenian translation of the MISA. If its reliability and validity are confirmed, it will be advisable to adopt it for routine assessment of feeding of neurological patients in Slovenia.

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