Slovenian Medical Journal

Inter-rater reliability in the Testing methods of the International Dysphagia Diet Standardization Initiative (IDDSI) in Slovenian language

Skladnost med ocenjevalci pri uporabi testnih metod Mednarodne iniciative za standardizacijo diet pri disfagiji v slovenščini

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Abstract

Background: Texture modification of drinks and food is a widespread clinical intervention for managing dysphagia. The descriptive and experiential approach to measurement is mainly used by healthcare professionals, caregivers, and patients. This study examines the inter-rater reliability of the International Dysphagia Diet Standardization Initiative (IDDSI) Testing methods on different food samples from the hospital's central kitchen.

Methods: Nine previously trained healthcare professionals of different professional backgrounds and working experiences independently evaluated 34 food samples in IDDSI levels 4, 5, 6, and 7.1, using a Slovenian translation of the IDDSI Audit Tools. The 12 descriptive food characteristics were observed during the two consecutive days of data collection, representing 7 IDDSI Testing Methods. The Fleiss' Kappa was used as a measure of agreement.

Results: Perfect agreement among raters was found for the Fork drip test regarding both observed parameters: dripping and holding shape. All ratings of participants were completely the same. Therefore, Fleiss' Kappa is considered (κ =1) in both cases. Moderate agreement (κ = 0.583) was found in particle size assessment. Fair agreement was observed in the Fork Pressure Test (κ = 0.361) and Finger Test, indicating bolus separation (κ = 0.328), pressure (κ = 0.305), and moisture (κ = 0.297). Fair agreement was also found for the Fork/Spoon Separation Test (κ = 0.265) and the Spoon Tilt Test in parameters of holding shape on the spoon (κ =0.233) and stickiness (κ = 0.327). No statistically significant results were found in the assessment of adhesiveness (κ = 0.059) in the Spoon Tilt Test and assessment of a typical pattern (κ = 0.039) in the Fork Pressure Test.

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Key words: inter-rater reliability; testing methods; IDDSI; dysphagia; texture-modification

Ključne besede: zanesljivost med ocenjevalci; testne metode; IDDSI; disfagija; teksturno prilagajanje

Received / Prispelo: 29. 9. 2023 | **Accepted / Sprejeto:** 28. 12. 2023

Cite as / Citirajte kot: Pogorelčnik T, Vogrinčič B. Inter-rater reliability in the Testing methods of the International Dysphagia Diet Standardization Initiative (IDDSI) in Slovenian language. Zdrav Vestn. 2024;93(5–6):160–70. **DOI:** https://doi.org/10.6016/ZdravVestn.3474

Conclusions: The study proved the Fork Drip Test to be a comprehensive and highly reliable assessment tool, while the other IDDSI Testing Methods showed low inter-rater reliability. The study highlights the risks of low agreement among raters. It draws attention to the IDDSI descriptors, which should be improved with additional instructions or standardised training protocol for learning the IDDSI Testing Methods.

Izvleček

Izhodišča: Prilagajanje konsistence hrane oz. tekočine je razširjen klinični ukrep pri obvladovanju disfagije. Strokovnjaki, negovalci in bolniki večinoma uporabljajo opisne in izkustvene načine za preverjanje ustreznosti teksture in konsistence hrane. Ta študija preučuje skladnost med ocenjevalci pri uporabi testnih metod Mednarodne Iniciative za standardizacijo diet pri disfagiji (*angl.* International Diet Dysphagia Initiative, IDDSI) na različnih vzorcih hrane, ki jih je pripravila centralna bolnišnična kuhinja.

Metode: Skupaj 9 posebej usposobljenih zdravstvenih delavcev z različnim strokovnim ozadjem in delovnimi izkušnjami je z uporabo slovenskega prevoda ocenjevalnega orodja IDDSI Audit Tools neodvisno ocenilo 34 vzorcev hrane v stopnjah IDDSI 4, 5, 6 in 7.1. V dveh zaporednih dneh zbiranja podatkov so opazovali 12 opisnih značilnosti živil, ki so skupaj predstavljale 7 testnih metod IDDSI. Za oceno zanesljivosti so uporabili koeficient Fleiss Kappa.

Rezultati: Pri testu kapljanja z vilic je bilo ugotovljeno popolno soglasje med ocenjevalci glede obeh opazovanih parametrov: kapljanje in ohranjanje oblike. Vsi odgovori ocenjevalcev so bili popolnoma enaki, zato lahko Fleiss kappa razumemo kot popolno ujemanje med ocenjevalci (κ = 1). Pri oceni velikosti koščkov hrane je bilo ugotovljeno zmerno ujemanje (κ = 0,583). Delno ujemanje je bilo ugotovljeno na testu s pritiskom vilic (κ = 0,361) in testu s prsti za parametre: razkosanje bolusa (κ = 0,328), pritisk (κ = 0,305) in vlažnost (κ = 0,297). Prav tako je bilo delno ujemanje ugotovljeno za test razkosanja z vilicami/žlico (κ = 0,265) in test nagiba žlice za parametra ohranjanje oblike (κ = 0,233) in lepljivost (κ = 0,327). Statistično neznačilne so bile ocene skladnosti za adhezivnost na testu nagiba žlice (κ = 0,059) ter med opazovanjem odtisa vilic pri testu s pritiskom vilic (κ = 0,039).

Zaključek: Študija dokazuje, da je test kapljanja z vilic kot ocenjevalno orodje razumljivo opisan test in ima visoko zanesljivost med ocenjevalci. Ocenjevanje teksturno prilagojene hrane z ostalimi testnimi metodami IDDSI pa izkazuje prenizko zanesljivost med ocenjevalci. Študija opozarja na tveganja ob slabem ujemanju med ocenjevalci in osvetljuje vidike, ki bi jih po taksonomiji IDDSI morali dopolniti z dodatnimi opisi, navodili ali standardiziranim programom učenja testnih metod.

1 Introduction

The texture of foods and liquids plays a significant role in how the material is perceived, processed, manipulated in the mouth, and finally swallowed. Textural properties correlate highly with physiological behaviours during ingestion (jaw movement, tongue pressure, saliva production, and swallowing patterns). Therefore, texture modification is a widespread clinical intervention for patients with swallowing disorders (dysphagia) and has beneficial effects on bolus control during the oropharyngeal phase of swallowing (1,2). Moderate thickening of liquids slows down the bolus flow and allows more time for the airway closure of an individual (3), having a protective effect against penetration and aspiration (4). Contrarily, very thick liquids and solid foods require greater tongue propulsive and pharyngeal constrictor forces, intact dental prosthetics and masticatory strength for biting, chewing, and smashing material into a cohesive bolus, thus ensuring sufficient pharyngeal clearance. Modifying food properties (such as dicing, chopping, mincing, or pureeing) compensates for the patient's difficulties with oral processing and food manipulation (4).

1.1 The International Dysphagia Diet Initiative (IDDSI)

A framework with common terminology and definitions was released in 2015 by an international group of experts to answer the problem of notable variability of the texture modification approaches among cultural, national, and clinical environments (5). The International Dysphagia Diet Initiative (IDDSI) Framework is a continuum of 8 texturally modified liquid and food levels, identified by numbers, text labels, colour codes, and definitions (6). The first referential documents were published in 2017 and updated in 2019 (6,7). Before the IDDSI release, Slovenian clinical practice lacked national guidelines regarding texture modification in

dysphagia management. The official translations of the IDDSI Framework and the IDDSI Testing Methods were first published in 2019, followed by an updated version in 2021 (8,9). The Initiative was gradually implemented at the University Medical Centre Ljubljana (UMCL) (10), followed by the Division of Paediatrics, UMCL, in 2022. Despite the availability of IDDSI in Slovenia, recent studies showed the persistence of heterogeneity of texturally modified diets among clinical settings (11,12). Lack of gradation between texturally modified food levels and fluid viscosities in non-IDDSI taxonomies makes the healthcare professional's decision-making, communication between settings, and the patient's rehabilitation process unnecessarily difficult (11,13).

1.2 Measurements of texturally modified liquids and food

Instrumental assessment of texture properties is widely used in food product development and quality control among food industries and swallowing research but not in the everyday clinical management of swallowing disorders. In dysphagia research, liquid properties are more widely studied, usually focused on shear viscosity and extensional viscosity, measured with rheometers (14). Texturally modified food assessment is studied less, focusing on commercial products that allow its reproducibility. In such cases, a texture analyser is used, using extrusion tests to measure foods' hardness/firmness, adhesiveness, and cohesiveness (15). Together with geometrical attributes (shape and size), these are important food parameters in dysphagia management (6).

Technology that simulates human behaviours in the mouth, e.g. cutting, compressing, shearing, and stretching, is expensive, difficult to carry around and requires skilled personnel to perform accurate measurements. The texture analyser is mainly inaccessible to healthcare professionals, caregivers, or patients with dysphagia (16). Also, the agreement on the experimental settings that would be the best to use and provide the most informative data to a medical environment is still in debate. Accordingly, the descriptive methods have been widely used among healthcare professionals. Currently, the most globally used are the IDDSI Testing Methods, which are simple, inexpensive testing methods for chefs, healthcare professionals, patients, and caregivers (6) to evaluate texture compliance with the IDDSI descriptors. Although IDDSI requires strict adherence to particle size (4 mm for adults and 2 mm for children in Level 5, 15 mm for adults and 8 mm for children in Level 6), moisture content, and other food texture characteristics (6), the testing methods are easy to perform, using syringe, spoon, fork, chopsticks, or fingers.

A systematic review published in 2020 (17) found no articles that would directly and mainly assess the metrological characteristics of the IDDSI Framework or Testing Methods. Only a few studies reported the reliability of the IDDSI Testing methods, mainly focused on the characteristics of commercially available liquids or thickening agents, using the IDDSI Flow Test (17-19), proving its high inter-rater agreement. The reliability of the IDDSI Testing Methods on food samples is widely understudied (17), especially in measuring hospital-provided or home-prepared texturally modified meals. A recent Swedish study offers promising data from their raters, who classified different liquids and food samples to IDDSI levels with a high degree of agreement (20). Furthermore, an earlier study recognised the Spoon Tilt Test (STT) as a reliable measure of cohesiveness and the Fork Pressure Test (FPT) as a reliable measure of hardness (21). However, the degree of agreement was found insufficient in the Fork Drip Test (FDT) (22). The usage and reliability of a total set of IDDSI Testing Methods on hospital or home-provided meals is understudied worldwide. It is crucial to question and evaluate the freely available materials and tools for dysphagia management, routinely used in everyday clinical practice and frequently offered to patient's caregivers. The instructions must be written to be understood and implemented by everyone, even the lay public. On the other hand, the high reliability of the testing methods could point to modified food non-compliance with the requirements promptly and prevent possible complications. This study examines the inter-rater reliability of the Slovenian translation of the IDDSI Testing methods using the IDDSI Audit Tools checklists on different texturally modified food samples from the hospital's central kitchen.

2 Methods

This paper is part of more extensive research about dysphagia outcomes in stroke survivors in acute care, which was approved by the National Medical Ethics Committee of the Republic of Slovenia (No. 0120-255/2029/3, 14.07.2020). Patients were not involved in this sub-study, nor did the study affect the patient's treatment. The study's results were not used to examine the performance of the employed staff at UMCL.

2.1 Instrument description

2.1.1 IDDSI Testing methods and Audit tools

To systematically perform the IDDSI Testing Methods on different texturally modified food samples, the Slovenian translation of the IDDSI Audit Tools (23) was used for diets in IDDSI Levels 4, 5, 6, and 7.1. The Audit Tools are prepared as a checklist with a dichotomous scoring system (yes – indicates compliance with the level requirements, no - indicates non-compliance). The Audit tools include statements relevant to the particular IDDSI level, using carefully selected IDDSI Testing Methods (Table 1).

2.1.2 Translation process

Permission for translation was obtained from the IDDSI Board of Directors. The translation was performed in a five-step translation and adaptation

Table 1: The International Dysphagia Diet Standardization Initiative (IDDSI) Testing methods[1] with their corresponding observed parameters and their influence on a specific oral physiological act and relevant IDDSI level. In this study, the food sample levels in bold were used to measure the inter-rater reliability.

The IDDSI testing methods	Observed parameters	Influenced physiological process	The IDDSI Audit Tool	Number of samples assessed for the specific parameter
Fork drip test (FDT)	Dripping between the prongs of a fork	Oral bolus control and processing time Timed swallowing act	4	12
	Holding the shape on the fork			12
Particle size (PS)	2-4mm	Mastication and number of chewing cycles Swallowing onset trigger	5	8
	15x15mm	Mastication and number of chewing cycles Choking and asphyxiation prevention	6	
Spoon Tilt Test (STT)	Adhesiveness	Oral and pharyngeal residue clearance Tongue propulsion an protrusion forces	4, 5	15
	Cohesiveness			15
	Stickiness			15
Fork Pressure Test (FPT)	Print of a fork's typical pattern on the food sample surface	Tongue propulsion and protrusion forces Number of chewing cycles Oral processing time	4	12
	Hardness/Firmness		5, 6, 7.1	14
Fork/Spoon Separation Test (FSST)	Hardness/Firmness	Tongue propulsion and protrusion forces Biting and chewing cycles Oral processing time	5, 6, 7.1	24
Finger Test (FT)	Adhesiveness	Oral and pharyngeal residue clearance Tongue propulsion and protrusion forces Biting and chewing cycles Oral processing time	4, 5, 6, 7.1	14
	Cohesiveness		4, 5, 6, 7.1	16
	Hardness/Firmness		4, 5, 6, 7.1	19

Legend: IDDSI - The International Dysphagia Diet Standardization Initiative; FSST – Fork Spoon Separation Test; FPT – Fork Pressure Test; FT- Finger Test; FDT – Fork Drip Test; FPT – Fork Pressure Test; STT – Spoon Tilt Test; [1] - This study did not include the chopstick test due to its irrelevance in the Slovenian cultural environment.

process: (I) Two speech and language pathologists performed the initial translation from English to Slovenian; (II) The synthesis of the translation formed the initial version; (III) An independent translator performed a back-translation; (IV) discrepancies were discussed between Speech and Language Pathologists and independent translator until the complete Slovenian version; (IV) The final Slovenian translation was obtained and pre-tested by the authors of this article; (V) The complete version was published online (23). A few recent studies fragmentally obtained internal consistency, test-retest reliability, and construct validity for some IDDSI tests (17,19-22,24-26).

2.1.3 Raters

Nine multidisciplinary team members of different areas and levels of expertise rated the food samples: 2 Speech and Language Pathology interns, 1 Clinical Speech and Language Pathology resident, 1 experienced Clinical Speech and Language Pathologist, 3 dietitian interns, 1 experienced Occupational Therapist and 1 experienced Physiotherapist. By experience, we mean participants having more than 10 years of working experience. Recruitment occurred through open calling for volunteers within the multidisciplinary team, targeting non-doctor team members who met the following inclusion criteria: having a general awareness of dysphagia, availability in meal times (breakfast 8.45 - 9.15h and lunchtime 12.45-13.15h) for five consecutive days Mon-Fri, and willingness to learn about IDDSI. The study took place between 26 and 30 June 2023. The variation in profession and duration of clinical experience was wide, ranging from 1 to 24 years of working experience (mean (SD): 8.56 (9.67)) and essential for the study to observe the reliability among individuals with different backgrounds. Participants' experience with dysphagia management and texturally modified meals was equal to their general working experience. However, their familiarity with the IDDSI descriptors ranged from 1 to 5 years (mean (SD): 2.78 (1.62)).

2.1.4 Food samples

The 34 food samples were provided from the UMCL's central kitchen, where all the meals for the patients are prepared and served on individual plates, protected with thermally insulated covers. Transportation time from the kitchen to the hospital ward was approximately 1 hour. Food samples were not controlled for temperature. All the participants rated the samples within 30 minutes after arriving at the ward. To avoid sample destruction due to the multiple manipulations of the food samples between the raters and to keep the risk of variability between samples at a minimum, the participants performed testing methods on two sets of food samples (4 raters/one sample set). Food samples were prepared in identical cooking conditions and served from the same stockpots. All the included food samples are listed in supplementary data.

2.2 Data collection and analysis

2.2.1 Study design

Regardless of participants' familiarity with the IDDSI descriptors and testing methods, all raters received a print of referential IDDSI documents in Slovenian (8,9). The training was performed by one of the authors of this article, who is also a co-author of the Slovenian translation of the IDDSI Framework and the Testing Methods. Both training days were formatted similarly and included two sessions per 45 minutes during mealtimes. In total, raters received 180 min of training and had the opportunity to self-study with freely available IDDSI materials.

On both days, the training was performed at breakfast and lunchtime. During breakfast, all the testing methods on all food sample levels (IDDSI 4-7. 1) were described and demonstrated using the IDDSI Audit Tools. The adequacy and inadequacy of food samples were observed, highlighted, and explained. The consequences in case of food non-compliance for dysphagic patients were clarified. The group discussed observations and jointly marked the results. In the lunch session, the raters performed the testing methods individually, with an opportunity to ask a trainer for further explanation or demonstration.

Food sample assessment and data collection followed the training phase. Participants were not blinded for the aim of the study but received instructions to keep their results private from others.

2.2.2 Inter-rater reliability

The inter-rater reliability of the IDDSI Audit Tools was obtained by comparing the results of healthcare professionals from different professional backgrounds. Participants were asked to judge the compliance of texturally modified food samples with the IDDSI Audit Tools (yes/no) for levels 4, 5, 6, and 7.1.

2.2.3 Data collection and statistical analysis

Data was collected in Microsoft® Excel®, 2016. All statistical analyses were calculated in a free software environment for statistical computing and graphics R (version 4.0.2, R Foundation for Statistical Computing).

To assess the inter-rater reliability, we utilised Fleiss' Kappa as a measure of agreement, particularly suited for analyses involving more than two raters and nominal data (27). It considers both the observed agreement among raters and the agreement expected by chance and yields a coefficient ranging from -1 to 1. Positive values indicate agreement beyond what would be expected by random chance, values close to 0 suggest agreement due to chance, and negative values represent disagreement. By employing Fleiss' Kappa, we aimed to quantify the level of agreement among multiple raters beyond chance and provide insights into the reliability of their dichotomous responses.

We adopted a commonly used interpretation framework for Fleiss Kappa values to assess the level of agreement among raters. The interpretation categories are as follows: poor agreement (< 0), slight agreement (0-0.20), fair agreement (0.21-0.40), moderate agreement (0.41-0.60), substantial agreement (0.61-0.80), and almost perfect agreement (0.81-1) (27). The p-value of less than 0.05 was considered statistically significant. Mean estimations and a 95% confidence interval (95% CI) were used to determine the inter-rater reliability.

3 Results

All 9 raters completed the training. Measurements were collected on the days immediately after the training period. Unfortunately, some participants did not provide judgement of all the food samples, and their results were excluded from the statistical analysis. The analysis was mainly based on the available data from 8/9 raters and 7/9 raters for particle size assessment. Samples of gelled coffee, chocolate milk, and panna cotta in IDDSI level 4 were excluded from the analysis due to the fast liquefaction of the samples in repetitive testing of different testators. There were 12 different parameters observed in the tested food samples, representing 7 IDDSI Testing Methods. In two consecutive days, raters tested 34 food samples in IDDSI levels 4, 5, 6 and, 7.1. The main results of the study are summarised in Table 2.

Perfect agreement in responses among raters was found for the FDT regarding both observed parameters: dripping and holding shape. All ratings of participants were completely the same. Therefore, Fleiss' Kappa for those tests is considered to be $\kappa = 1$. The associated p-value ($p < 0.001$) signified a statistically significant level of agreement.

Moderate agreement was found for assessing particle size in levels 5 and 6, with inter-rater reliability being $\kappa = 0.583$ (95% CI: 0.366 - 0.799), signifying a statistically significant level of agreement ($p < 0.001$). A fair agreement was found for FPT in levels 6 and 7.1, with $\kappa = 0.361$ (95% CI: 0.229 - 0.493), for the Finger Test (FT) indicating bolus separation in levels 5 and 7.1 with $\kappa = 0.328$ (95% CI: 0.184 - 0.472), pressure in levels 6 and 7.1 with $\kappa = 0.305$ (95% CI: 0.176 - 0.434), and moisture of the food samples in levels 5, 6 and 7.1 with $\kappa = 0.297$ (95% CI: 0.173 - 0.421). Fair agreement was also found for the Fork/Spoon Separation Test (FSST), with inter-rater reliability being $\kappa = 0.265$ (95% CI: 0.154 - 0.376) tested on levels 5, 6 and 7.1 and for the STT: holding shape $\kappa = 0.233$ (95% CI: 0.087 - 0.377) and stickiness $\kappa = 0.327$ (95% CI: 0.185 - 0.468). All mentioned tests signified a statistically significant level of agreement ($p < 0.001$).

No significant agreement ($p > 0.05$) was found in the FPT-typical pattern in level 4 with $\kappa = 0.039$ (95% CI: -0.131 - 0.208), $p = 0.417$ and assessment of adhesiveness in STT in levels 4 and 5, $\kappa = 0.059$ (95% CI: -0.083 - 0.201) and $p = 0.165$.

The results on the confidence intervals are relatively wide and reflect inherent variability in the inter-rater reliability estimate. Accordingly, we decided to keep the kappa value to interpret the reliability outcome.

4 Discussion

Ours is the first such study conducted in Slovenia using the Slovenian translation of the IDDSI Testing Methods, the first ever internationally published study using the IDDSI Audit Tools, and the first study observing inter-rater reliability of non-commercial, texturally-modified meals provided by the hospital's central kitchen for the patients with swallowing disorders.

A perfect agreement in food samples of IDDSI level 4, using the FDT, was found due to the perfect match of raters' answers for both observed parameters: bolus dripping and holding shape, which is a promising result of perfect inter-rater reliability. Comparing our results to the outcomes of a previous study (22), they reported more explicit responses in food samples with high apparent compliance or non-compliance with the criterion but more inconsistencies in responses on the intermediate samples. In our study, participants considered all food samples tested with FDT compliant with the criterion, which might, similarly to a previous study (22), explain why there was a perfect agreement among raters found in this study.

Table 2: Fleiss Kappa scores for the International Dysphagia Diet Standardization Initiative (IDDSI) Testing Methods in texturally modified food samples.

Test	Food samples (n)	Raters (n)	Food samples (n)	Kappa	95% confidence interval	p-value	Estimated agreement category
Fork Spoon Separation Test (FSST)	24	8	24	0.265	0.154 - 0.376	$p < 0.001$	Fair agreement
Fork Pressure Test (FPT)	14	8	14	0.361	0.229 - 0.493	$p < 0.001$	Fair agreement
Finger Test (FT) - Separation	14	8	14	0.328	0.184 - 0.472	$p < 0.001$	Fair agreement
Finger Test (FT) - Pressure	16	8	16	0.305	0.176 - 0.434	$p < 0.001$	Fair agreement
Finger Test (FT) - Moisture	19	8	19	0.297	0.173 - 0.421	$p < 0.001$	Fair agreement
Particle Size	8	7	8	0.583	0.366 - 0.799	$p < 0.001$	Moderate agreement
Fork Drip Test (FDT) - dripping	12	8	12	1	/	$p < 0.001$	Perfect agreement
Fork Drip Test (FDT) - holding shape	12	8	12	1	/	$p < 0.001$	Perfect agreement
Fork Pressure Test (FPT) – a typical pattern	12	8	12	0.039	-0.131 - 0.208	$p = 0.417$	No significant agreement
Spoon Tilt Test (STT) - adhesiveness	15	8	15	0.059	-0.083 - 0.201	$p = 0.165$	No significant agreement
Spoon Tilt Test (STT) - holding shape	15	8	15	0.233	0.087 - 0.377	$p < 0.001$	Fair agreement
Spoon Tilt Test (STT) - stickiness	15	8	15	0.327	0.185 - 0.468	$p < 0.001$	Fair agreement

Legend: IDDSI - The International Dysphagia Diet Standardization Initiative; FSST – Fork Spoon Separation Test; FPT – Fork Pressure Test; FT- Finger Test; FDT – Fork Drip Test; FPT – Fork Pressure Test; STT – Spoon Tilt Test.

The particle size is one of the most objective IDDSI descriptors, using spacing between prongs and fork's width as a measure criterion. The IDDSI descriptors predict particle size as 4 mm for adults and 2 mm for children in Level 5, and 15 mm for adults and 8 mm for children in Level 6 (8). We expected a high inter-rater agreement in the particle size assessment, but only moderate agreement was found with $\kappa = 0.583$. The possible divergences among raters from our study may originate from different sizes of pieces that were served on a plate, some of them in greater or smaller compliance with the criteria, which made it difficult for the participants to decide on the overall appropriateness of the food sample.

FPT, FT, and FSST imitate bolus behaviour in the mouth and indirectly measure the patient's need for tongue propulsion and protrusion forces during the oral preparatory phase of swallowing (28). Previous studies used the IDDSI Testing Methods to validate the samples of newly developed products for dysphagia sufferers (e.g., FPT) (24), even though the validity or reliability of the tests was not fully explored. Our study found a fair agreement among raters for FPT, FT, and FSST, which indicates some degree of agreement beyond what would be expected by chance but not enough to manage a life-threatening pathology. Preliminary trials of a recently published study (24) observed that the relative position of the food sample along the fork tines requires substantially different pressure on the food sample and may influence the test's result. Consequently, raters' performance of FPT may differ in the compression speeds and resting times on the compressed food. Misusing FPT may lead to incorrect observations (29), possibly resulting in low inter-rater agreement of our study.

Similarly, STT had also been used to validate texturally modified meals (25), with no prior psychometric evaluation of the test itself. Our study found a fair agreement for STT in two of the three measured parameters: holding shape and stickiness of the bolus. Both parameters correlate with possible residues in the patient's oral or pharyngeal cavity after swallowing (30). Our finding

indicates that assessing the sample's ability to hold the shape on the spoon and subjectively measure its residue on the spoon after tilting the spoon sideways appears rather challenging and raises concerns for their application in clinical practice. The assessment of STT adhesiveness revealed no statistical significance in the agreement among raters. According to the collected data, only a chance agreement is in play here. This STT descriptor states that the sample may spread or slump slowly on a flat plate (8), allowing some degree of possibility that may or may not be obtained. This flexibility appears in English and the Slovenian STT descriptor of the IDDSI and caused relative confusion to our participants in the training and, apparently, the assessment period. Comments on similar findings on the performance and interpretation of the STT were not found in any previous studies (14,16,21). This observation of our study draws attention to the need to improve the IDDSI descriptors, which should be supplemented with additional explanation.

Regarding FPT, we analysed the results separately for level 4 because the observed instructions were different from the FPT in levels 6 and 7, as explained above. The data collected from the FPT-typical pattern for level 4 showed no significant agreement between the raters. Therefore, it is likely that only chance agreement is in play here.

The results of this study suggest more careful use of the IDDSI Testing Methods in everyday clinical practice, showing low agreement among raters when used with non-commercial, hospital-provided meals. Significant variation regarding professional background and years of working experience among raters might reflect poor inter-rater reliability from this study, but the diversity among IDDSI users is inevitable. Testing methods should be reliable for everyone who undergoes a particular presentation, counselling, or training session. Further research should focus on developing and researching different training protocols to find a standardised educational approach for training the users on the IDDSI Testing Methods. The IDDSI Testing Methods are meant to be performed in clinical practice by an individual testator, a healthcare professional, a caregiver or a patient himself. A high or perfect ($\kappa > 0.80$) inter-rater reliability would be expected from the assessment tools in clinical practice (31).

Limitations of this study lay in the uncontrolled conditions of the food sample set, regarding the temperature and possible variability of the food piece size in the meals of the higher IDDSI levels (especially level 6). However, possible non-compliance with the IDDSI descriptors is an everyday issue for each chef, cook, or caregiver. Future research on non-commercial meals in dysphagia research is crucial to identify everyday risk factors in food preparation for people with dysphagia, considering and controlling as many environmental conditions as possible.

The wide confidence intervals for particle size assessment, FT, FSST, and STT, showed inherent variability in the inter-rater reliability estimate, possibly due to the low number of participants or small set of assessed food samples, which could be improved in future studies on the reliability of the IDDSI Testing Methods.

This study proved FPT to be the only reliable test to measure food compliance with the IDDSI level 4 and its perfect inter-rater reliability. The outcomes raise an important consideration for future practice in dysphagia management and underscore the need to investigate the reliability of the globally proposed testing methods.

5 Conclusion

Treatment of dysphagia is the responsibility of all team members within a multidisciplinary team. Proper recognition of possible non-compliance with texturally modified meals with recommended descriptors and immediate response to them is crucial for adequate dysphagia management. Although this study gives an insight into the worldwide understudied inter-rater reliability of the IDDSI Testing methods, the conclusions could only be made for the Slovenian translation of the IDDSI Audit Tools, measured after the described two-day training programme. Our data proved the FDT to be a comprehensive and highly reliable assessment tool, while other IDDSI Testing Methods showed low inter-rater reliability. Future research should focus more on the IDDSI descriptors and their corresponding testing materials. Our findings also encourage the global IDDSI community to develop a standard training program for new IDDSI users, especially healthcare providers and caregivers.

Conflict of interest

None declared.

Supplementary Data

The supplementary material includes a list of measured food samples in the Slovenian and English languages.

Acknowledgements

We thank the multidisciplinary team members who assessed the food samples and enabled the completion of this study.

Supplementary material: List of food samples included in the study.

	Food sample	Meal	Assessment date	IDDSI Level
1	A slice of white bread Kos belega kruha	Breakfast	29 June 2023	7.1
2	Mixed fruit compote (apples and plums) Kompot iz mešanega sadja (jabolka in slive)	Breakfast	29 June 2023	7.1
3	A slice of Tilsit cheese, Livada, Pomurske mlekarne Rezina poltrdega sira tilzit, Livada, Pomurske mlekarne	Breakfast	29 June 2023	7.1
4	A slice of milk bread with cheese spread Kos mlečnega kruha s sirnim namazom	Breakfast	29 June 2023	6
5	Čokolino (Podravka) with regular milk Čokolino (Podravka) z običajnim mlekom	Breakfast	29 June 2023	4
6	Mixed apricot jelly Marelična strjenka	Breakfast	29 June 2023	4
7	Mixed fruit compote (apples and plums) Kompot iz mešanega sadja (jabolka in slive)	Breakfast	30 June 2023	7.1
8	A slice of rye bread Kos rženega kruha	Breakfast	30 June 2023	7.1
9	Scrambled eggs Vmešana jajca	Breakfast	30 June 2023	7.1
10	Scrambled eggs Vmešana jajca	Breakfast	30 June 2023	6
11	A slice of milk bread Kos mlečnega kruha	Breakfast	30 June 2023	6
12	Mixed apricot jelly Marelična strjenka	Breakfast	30 June 2023	4
13	Keksolino (Podravka) with regular milk Keksolino (Podravka) z običajnim mlekom	Breakfast	30 June 2023	4
14	Trout file File postrvi	Lunch	29 June 2023	7.1
15	Boiled potatoes with chard Krompir z blitvo	Lunch	29 June 2023	7.1
16	Sponge cake Biskvitno pecivo	Lunch	29 June 2023	7.1
17	Trout file File postrvi	Lunch	29 June 2023	6
18	Cooked trout Kuhana postrv	Lunch	29 June 2023	5
19	Mashed potatoes Pire krompir	Lunch	29 June 2023	4
20	Cooked trout Kuhana postrv	Lunch	30 June 2023	4
21	Chard Blitva	Lunch	29 June 2023	4

	Food sample	Meal	Assessment date	IDDSI Level
22	Mixed soup: beef and chard Mešana juha: govedina in blitva	Lunch	29 June 2023	4
23	Pork paprikash Svinjski paprikaš	Lunch	30 June 2023	7.1
24	Cauliflower salad with vinegar Solata: cvetača v kisu	Lunch	30 June 2023	7.1
25	Turkey steak in natural sauce Puranji zrezek v naravni omaki	Lunch	30 June 2023	6
26	Corned beef hash soup Goveji haše	Lunch	30 June 2023	5
27	Cornmeal mush Polenta	Lunch	30 June 2023	5
28	Mashed potatoes Pire krompir	Lunch	30 June 2023	4
29	Mixed beef Govedina miksana	Lunch	30 June 2023	4
30	Cauliflower Cvetača	Lunch	30 June 2023	4
31	Soup: cauliflower and beef Juha: cvetača in govedina	Lunch	30 June 2023	4
32	Panacota – omitted from the analysis Panakota	Lunch	29 June 2023	4
33	Gelled coffee – omitted from the analysis Zgoščena kava	Breakfast	29 June 2023	4
34	Gelled chocholate milk – omitted from the analysis Zgoščeno čokoladno mleko	Breakfast	30 June 2023	4

Legend: IDDSI - The International Dysphagia Diet Standardization Initiative.

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