IZVORNI ZNANSTVENI RAD / ORIGINAL SCIENTIFIC PAPER

Validation and Modification of a Short Diet Screener "Diet Analysis"

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Abstract

Short questionnaires are increasingly used tools for quickly assessing dietary quality. In this study, a new questionnaire called "diet analysis" was validated and modified. The questionnaire consisting of 18 questions divided into 3 categories (completion time: 3-5 minutes). The objective was to compare the relative validity of this questionnaire with the Healthy Eating Index mHEI-2015, based on a 7-day food diary completed by 46 participants (aged 19-66 years). Distribution of participants across five categories of diet quality were shown in mHEI-2015 scoring (mHEI) and "diet analysis" with proposed new scoring (DAn) while in the "diet analysis" (DA) participants were distributed across four categories of diet quality. The Bland-Altman plots demonstrated that the data were mostly uniformly distributed, in both analyses with old and new proposed scoring. Most participants (69.5% and 71.74%) had score differences within one standard deviation, indicating low variability among them. The results suggest agreement between DA and mHEI and DAn in assessing the dietary habits of most participants. Assessment of food intake of participants scoring 0, 1 or 2 points shows participants self-evaluated their intake properly. Proposed modifications to the scoring of the DA questionnaire are based on American dietary guidelines, the findings of this study and HEI-2015. It is suggested the final category of the questionnaire „relationship with food„ is excluded from scoring individual's diet but can be used for strategizing client care. The development of this tool, along with its demonstrated alignment with established indices such as mHEI-2015, underscores its potential to significantly streamline dietary assessments while maintaining accuracy and reliability. „Diet analysis" represents a valuable contribution to the field, addressing the need for accessible and user-friendly tools in dietary assessment and clinical practice.

Keywords: screener; short questionnaire; dietetic methods; questionnaire validation; diet analysis; diet quality

Sažetak

Kratki upitnici sve su češći alati za brzu procjenu kvalitete prehrane. U ovoj studiji potvrđen je i modificiran novi upitnik pod nazivom "analiza prehrane". Upitnik se sastoji od 18 pitanja podijeljenih u 3 kategorije (vrijeme ispunjavanja: 3-5 minuta). Cilj je bio usporediti relativnu valjanost ovog upitnika s Indeksom zdrave prehrane mHEI-2015, koji se temelji na 7-dnevnom dnevniku prehrane koji je ispunilo 46 sudionika (u dobi od 19 do 66 godina). Distribucija sudionika u pet kategorija kvalitete prehrane prikazana je u mHEI-2015 bodovanju (mHEI) i "analizi prehrane" s predloženim novim bodovanjem (DAn), dok su u "analizi prehrane" (DA) sudionici raspoređeni u četiri kategorije kvalitete prehrane. Bland-Altmanovi dijagrami pokazali su da su podaci uglavnom ravnomjerno raspoređeni, u obje analize sa starim i novim predloženim bodovanjem. Većina sudionika (69,5% i 71,74%) imala je razlike u rezultatima unutar jedne standardne devijacije, što ukazuje na nisku varijabilnost među njima. Rezultati sugeriraju slaganje između DA i mHEI i DAn u procjeni prehrambenih navika većine sudionika. Procjena unosa hrane sudionika s 0, 1 ili 2 boda pokazuje da su sudionici ispravno sami procijenili svoj unos. Predložene izmjene bodovanja DA upitnika temelje se na američkim prehrambenim smjernicama, nalazima ove studije i HEI-2015. Predlaže se da se posljednja kategorija upitnika „odnos s hranom" isključi iz bodovanja prehrane pojedinca, ali se može koristiti za strategiju brige o klijentu. Razvoj ovog alata, zajedno s njegovim dokazanim usklađivanjem s utvrđenim indeksima kao što je mHEI-2015, naglašava njegov potencijal da značajno pojednostavi procjene prehrane uz zadržavanje točnosti i pouzdanosti. „Analiza prehrane" predstavlja vrijedan doprinos ovom području, baveći se potrebom za dostupnim i korisniku prilagođenim alatima u procjeni prehrane i kliničkoj praksi.

Ključne riječi: sito; kratki upitnik; dijetetske metode; validacija upitnika; analiza prehrane; kvaliteta prehrane

Introduction

Nutrition plays a crucial role in maintaining optimal health and preventing diseases. To understand and assess the impact of diet on health, it is necessary to use reliable and validated tools for measuring diet quality (Knights et al., 2023). Dietary methods are used to measure the types and quantities of food consumed, as well as the intake of nutrients and other food components. These methods, along with anthropometric, biochemical, and clinical parameters, are used to assess the nutritional status of an individual or population. Various tools have been developed to assess diet quality, including the Healthy Eating Index (HEI), Alternative Mediterranean Diet (AMED), Dietary Approach to Stop Hypertension (DASH), The Diet Quality Index - International (DQI-I), and others. Dietary methods, such as food diaries, 24-hour recalls, and food frequency questionnaires, are used to assess dietary habits. Dietary methods may be exhaustive for data collection and processing. Therefore, there is a need for simpler tools such as short questionnaires that allow for a quick and efficient assessment of diet quality (Malinowska, 2021). Short questionnaires are a practical option consisting of a few questions or sets of questions that can be completed in a short time. They provide an overview of an individual's dietary habits without the need for a more extensive dietary assessment. Short questionnaires can also help identify the risk of dietary deficiencies and the risk of developing chronic diseases (Tang and Yang, 2023). However, it should be noted that short questionnaires have their limitations, including the possibility of recall bias, which can affect the results. Therefore, it is important to conduct validation studies to assess the relative validity of these tools. Finally, short questionnaires can be used as tools for educating individuals about healthy dietary habits and promoting behaviour change. The aim of this study was 1) to assess the relative validity of this newly created tool 2) to align the "diet analysis" with previously validated dietary methods, in this case, the mHEI-2015. The tool validated in this study will be integrated into clinical practice at a Croatian nutrition counselling centre, serving as an essential component of the primary assessment for clients seeking advice from dietitians. It's additional purpose it is aiding in the strategic planning aimed at promoting the overall health and dietary quality of clients.

Materials and methods

Screeners

In the review article by England et al. (2015), 35 short questionnaires were identified, developed for clinical use, 12 of which assess overall dietary quality, while others assess the intake of specific food groups. Additionally, 4 additional questionnaires were identified as modifications of those mentioned in the review article (Papadaki et al., 2018; Schröder et al., 2011; Segal Isacson et al., 2004; Townsend et al., 2003). According to Connor and Irani (2021), although a range of validated rapid tools for clinical use have been developed, there is no preferred tool, and the analysis goal, cultural and genetic differences among respondents, and practicality of use should be considered when selecting a tool.

The criteria for identifying short questionnaires in the review article were that they contain no more than 35 items, are readily accessible, easy to use, and score (England et al., 2015). Thus, tools with a number of questions ranging from 9 to 31 were identified. Although it is assumed that questionnaires with long lists of components may more accurately assess an individual's dietary quality, it has been shown that short questionnaires on dietary quality provide equally relevant data as more comprehensive methods and are more acceptable to respondents because they take less time (Malinowska, 2021; Kobayashi et al., 2011).

With the increasing number of short questionnaires, the number of validated and newly developed short questionnaires has also increased. Since the last review article in 2015, an additional 6 questionnaires have been validated. The questionnaires related to specific population groups such as athletes (Harrison et al., 2018), individuals with non-alcoholic fatty liver and cardiovascular diseases (Liu et al., 2022; Bredin et al., 2020), and the general population (Ku et al., 2022; Malinowska, 2021; Masip et al., 2019; Lafrenière et al., 2019). Additionally, existing short questionnaires have been adapted for various groups considering cultural differences, translated into different languages, and validated for easier use (Marendić et al., 2021; Machálková and Reiterova, 2021; Fromm and Horstmann, 2019; Gnagnarella et al., 2018). The American Heart Association (AHA) in 2020 (Vadiveloo, 2020) published a scientific statement identifying 15 short questionnaires that meet the requirements for easy use in clinical practice. The criteria for identification were focus on overall diet rather than individual food groups or nutrients, completion time for the short questionnaire not exceeding 10 minutes, ease of use, i.e., they can be completed by the general population without prior training by a nutritionist, providing guidance on desirable dietary changes, and can be linked to electronic health records for monitoring dietary habits over time (Vadiveloo, 2020).

For the purpose of this research, twenty-two short questionnaires were identified, using following criteria: used to assess the overall dietary quality of the general population, take no more than 10 minutes to complete, have fewer than 35 questions, and have been previously validated.

Study design

The data collection process occurred in two rounds. The first round of participant recruitment took place in December 2022 via social media, specifically the Facebook page of the Croatian nutrition counselling centre, nutricionizam.hr. Due to the low response rate from participants who completed the "diet analysis" (n=8) in the initial round of research invitations, a second round of participant recruitment was conducted in January 2023 through the official newsletter of nutricionizam.hr, which had over 18,000 subscribers at the time of the research. The research invitation was sent to 16,541 addresses. Of those, 4553 individuals, or 27.5%, opened the email, while 348 (7.6% of those opened) clicked on the link leading to the "diet analysis." Exclusion criteria was that participants were currently engaged with the consultancy, meaning if they have had an active personal nutritionist program or have had one in the past year, they couldn't be part of the study. A total of 258 completed

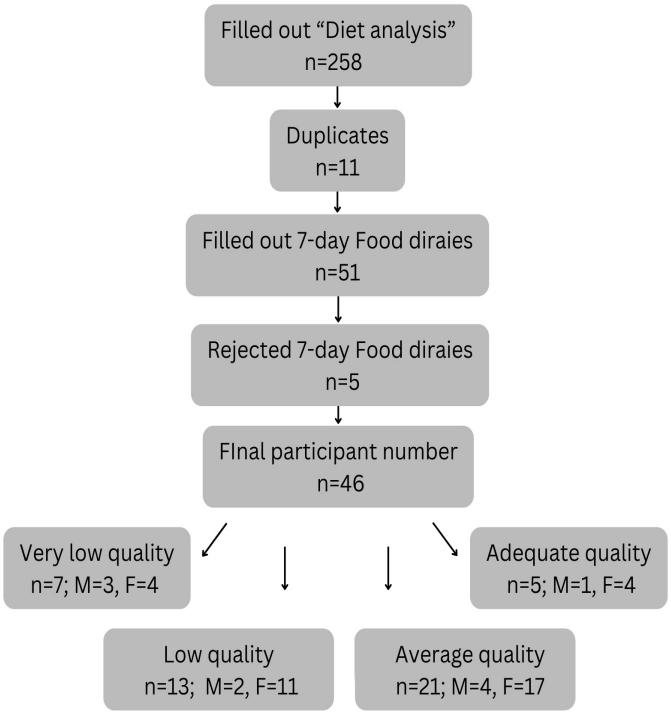

Figure 1. Participant recruitment process (n, number of participants; F, females; M, males).

Table 1. Descriptive characteristics of the studied population (n=46).

Parameter	Mean ± standard deviation
Age (years)	45.7 ± 14.5
Body mass index (kg/m2)	24.3 ± 5.2
Males (% subjects)	24.4
Females (% subjects)	75.6

forms were received (Fig. 1), of which 11 were duplicate entries from the same participant. The total number of participants who completed the "diet analysis" was 247, with an average age of 45.7 ± 14.5 years. A higher percentage of women completed the "diet analysis" - 75.6%, while 24.4% were men. Out of the total number of participants 79.4% of participants did not complete the 7-day food diary. The average age of participants who completed the food diary was 40.0 ± 14.0, with 23.5% being men and 76.4% being women (Table 1). Out of the total number of collected diaries, 9.8%, or 5 diaries, were not completed according to the given instructions and could not be used in the research. Therefore, the final number of participants who met all criteria was 46, of which 21.7% were men and 78.3% were women.

Diet analysis

The online "diet analysis" of the nutricionizam.hr nutrition counselling centre started in 2015 with the aim of facilitating the assessment of the dietary quality level of the general population in the Croatian-speaking area. Creator of the questionnaire is PhD Bojan Stojnić, who is also the founder and owner of the nutricionizam.hr nutrition counselling centre. The "diet analysis" was developed based on practical experience and inspired by questionnaires seen in scientific literature. At the time of the research, the "diet analysis" had over 50,000 completed questionnaires. The questionnaire is divided into three categories: general information, dietary quality, and the category of food relationship. The dietary quality category provides information on whether the individual's overall diet meets nutritional needs or not. The general information category includes questions about gender, age, and anthropometry to assess the energy needs of the person completing the questionnaire. The food relationship category is not often represented in such questionnaires (Malinowska, 2021; Marendić et al., 2021; Rothenberg et al., 2021; Robinson et al., 2017; Thompson et al., 2017; Segal-Isaacson et al., 2004) and includes emotional and psychological needs related to dietary habits and food. The questionnaire is available for online administration or in physical form.

The "diet analysis" carries a total of 30 points, and depending on the points obtained, it is divided into 5 groups of dietary quality: (a) Very low dietary quality; 0 - 10 points (b) Low dietary quality; 11 - 15 points (c) Average dietary quality; 16 - 20 points (d) Acceptable dietary quality; 21 - 25 points (e) Excellent dietary quality; 26 - 30 points.

Food intake assessment

To conduct the diet assessment, the online version of "diet analysis" was used. Based on the responses to three sets of questions, each participant was assigned a score ranging from 0 to 30. The lowest possible score was 0, while 30 was the highest. As a reference tool in the process of assessing the relative validity of the short questionnaire, a 7-day food diary was used. After completing the "diet analysis", within 24 hours, all participants received instructions and a template for filling out the 7-day food diary via email. The instructions provided detailed explanations on how to fill out the food diary. Participants estimated and recorded food quantities using measurements such as teaspoons, tablespoons, cups, and plates. Additionally, the importance of noting spices, oils, and fats used in cooking, as well as the intake of water and other fluids throughout the day, was emphasized. If participants needed to record a meal that was not prepared at home and were unsure of its exact composition, instructions were provided to indicate in the preparation method that it was a meal consumed outside the home, e.g., lamb stew and potatoes; quantity: 1 plate; restaurant.

Statistical analyses

The processing of "diet analysis" data is automatic. Immediately after filling out the questionnaire, the responses are stored in a separate online Google spreadsheet, which is accessible to all counselling centre employees. Within the spreadsheet, selected responses for each question are recorded, and the total number of points that an individual's diet deserves is displayed in the last column, ranging from 0 to 30 points.

7- day food diaries were reviewed to determine their proper completion and whether they were acceptable for further analysis. After reviewing, 46 (out of 51) 7-day food diaries were assessed. USDA Food Composition Database was used for processing and calculating data on food intake from collected 7-day food diaries. Since the participants estimated intake in teaspoons, tablespoons, cups, plates, portions of certain foods, and/or meals, the Dietary Guidelines for Americans 2020-202526 were used to convert quantities into metric units. Data processing using the Metric Healthy Eating Index (mHEI-2015) was crucial for further assessing the relative validity of the "diet analysis." The obtained values were used to determine the Metric Healthy Eating Index (mHEI-2015) to assess the correlation with the overall results of the short "diet analysis," or to determine food intake by groups according to questions from the "diet analysis". To determine the correlation between the results of two indicators of diet quality, "diet analysis" and mHEI-2015, the Bland–Altman method was used. The "diet analysis" scores were expressed as percentages for easier comparison with mHEI-2015 scores. The Kolmogorov-Smirnov (K-S) test concluded that the data were not normally distributed and are presented as medians and interquartile ranges (IQR). The Kruskall-Wallis test was used to compare the level of intake of food groups and/or nutrients with the scores obtained from completing the "diet analysis". Statistical data analysis was conducted using Microsoft Excel and available online calculators. Based on these results, several corrections to the diet analysis scoring system and question forms were suggested. The same steps were followed when determining the correlation between the "diet analysis" with proposed new scoring and mHEI-2015.

Results and discussion

Distribution across categories of diet quality

According to the results of the "diet analysis," m-HEI 2015, and the "diet analysis" with proposed new scoring, participants can be divided into five groups (Table 2) based on the quality level of their diet. The corrected scoring showed a better distribution across all categories, similar to mHEI-2015 distribution. Earlier research has indicated that individuals categorized as having a low-quality diet typically score a maximum of 56 out of 100 points on the Healthy Eating Index (HEI), whereas those classified with a high-quality diet typically score a minimum of 75 out of 100 points on the HEI (Harmon et al., 2015).

Table 2. Distribution of participants (n=46) across diet quality categories of used methods.

Diet quality	Diet Analysis	mHEI-2015	Diet Analysis Corrected Scoring
Very Low	15.2%	2.2%	10.9%
Low	28.3%	6.5%	28.3%
Moderate	45.7%	66.7%	39.1%
Acceptable	10.9%	39.1%	17.4%
Excellent	-	8.7%	4.3%

However, it's essential to acknowledge several limitations encountered during the study. One limitation is the sample size, which may have affected the generalizability of the findings. Despite efforts to recruit participants through social media and newsletters, the final sample size was relatively small. Future studies with larger and more diverse samples could provide a more comprehensive understanding of the validity and reliability of the "diet analysis" tool. Another limitation pertains to the reliance on self-reported data, which introduces the possibility of recall bias and social desirability bias. Participants may have inaccurately reported their dietary habits, leading to potential measurement errors. Incorporating objective measures, such as biomarkers of nutrient intake (e.g., blood levels of specific nutrients or metabolites), could complement self-reported data and enhance the accuracy of dietary assessments. For example, validation studies often compare questionnaire responses to biomarkers (Malinowska, 2021; Colić Barić et al., 2009).

Despite these limitations, the study provides valuable insights into the relative validity of the "diet analysis" tool compared to the mHEI-2015. The findings highlight the importance of using validated tools for assessing dietary quality in clinical practice and research settings. Addressing these limitations and pursuing future research avenues, including validation with biomarkers, will contribute to the ongoing refinement and validation of dietary assessment tools, ultimately enhancing our ability to promote healthy dietary habits and prevent chronic diseases.

Bland-Altman Plot

Bland-Altman chart quantifies the agreement of two quantitative measurements and as Markovikj et al (2023) stated, the range inside red lines presents the limits of agreement (±1.96 x standard deviation), while the dots outside this range present the outliers. In our case, the proportion of outliers is under 5 %, (4.3 % in both cases, Figure 2). The Bland-Altman method was used to determine the magnitude of the difference between scores obtained through the "diet analysis" and mHEI-2015 scores (Fig. 2a) and between scores obtained through "diet

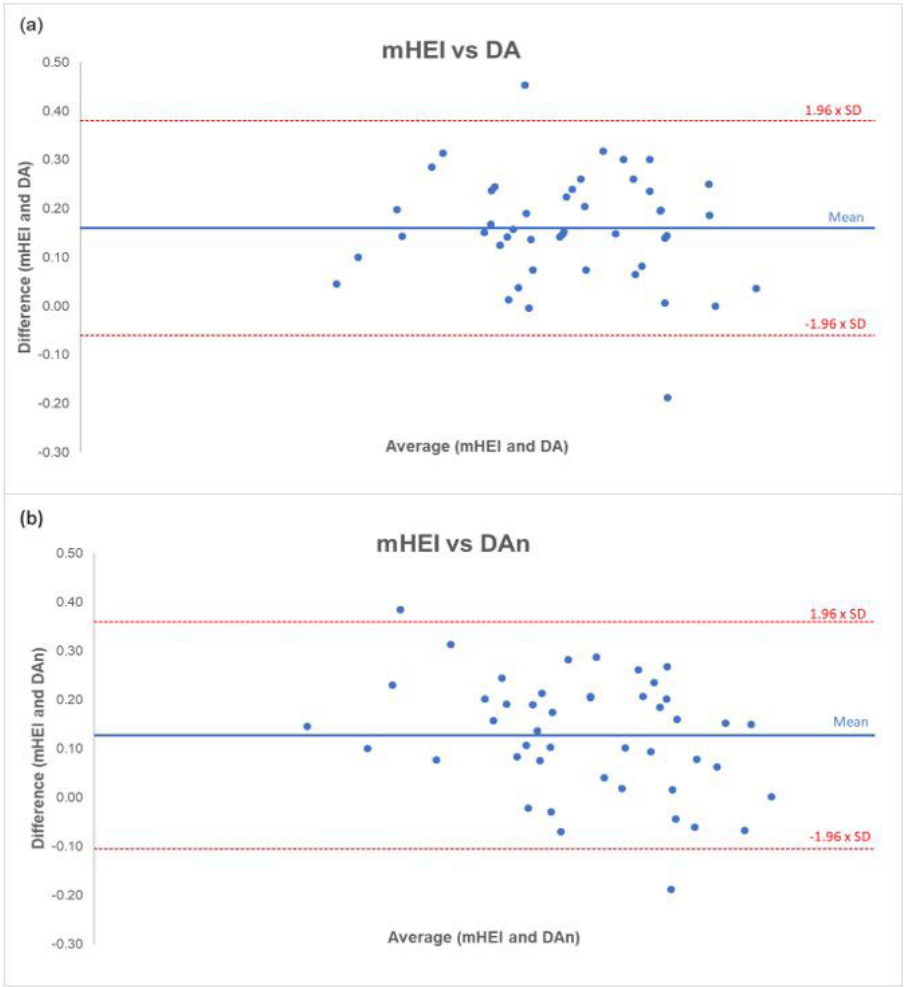

Figure 2. Bland–Altman plots of agreement between (a) "Diet analysis"(DA) and mHEI-2015; (b) "Diet analysis" with proposed corrected (DAn) scoring and mHEI-2015.

analysis" with proposed new scoring and mHEI-2015 scores (Fig. 2b). The Bland-Altman plots, in which 95% limits of agreement are shown, demonstrates mostly uniformly distributed data in both figures (Figs. 2a & 2b). Limits of agreement for fig. 2a) are from -6% to 37%, and for fig. 2b) from -10.5% to 36%. We can conclude that most participants had a similar score difference in both cases.

Given that 32 participants for figure 2a, or 69.5%, and 33 participants for figure 2b or 71.74% are within one standard deviation from the mean value, we can conclude that there is relatively small variability in score differences between the two types of analyses and mHEI-2015 among most participants. This may suggest that these two types of analyses agree on assessing dietary habits and parameters for most participants. The average scores, expressed as a percentage, obtained from the "diet analysis" are 53.2 ± 13.6%, and 56.37 ± 16.43% while the scores obtained from the dietary diary analysis using the mHEI-2015 index are higher, namely 69.1 ± 12.7% (Table 3).

Larger score deviations between these two methods were present in participants with very low or low-quality diets, while in the moderate-quality diet category, the deviation is slightly lower, and in the acceptable-quality diet category, there is no statistically significant difference in the obtained scores. Since the mHEI-2015 and most other dietary quality questionnaires do not consider the category of food relationship, while the "diet analysis" specifically focuses on a healthy relationship with food, it could be concluded that this is the reason for larger score differences between the "diet analysis" and mHEI-2015 in lower-quality diet groups. Research has shown that poor diet quality and feelings of guilt, or increased stress related to an individual's diet, are linked (Khaled et al., 2021; Schweren et al., 2021).

Food and nutrient intake assessment

Comparison of the intake of food for each category between people scoring 0, 1 or 2 in corresponding "Diet analysis" questions is shown in table 4. For each question, comparison of intake of nutrients was made which didn't show statistically significant difference between people scoring 0, 1 or 2 points. There are several possibilities to this, the variability of scores for each nutrient within a question could be high, second it is possible the distribution of participants scoring 0, 1 or 2 points is not even so a smaller sample within one of the groups could affect the P score. However, we can conclude, taking into consideration all main food groups show significant difference, that the participants in most cases self-evaluated their intake properly.

Proposed changes to "Diet analysis"

To increase the relative validity of the questionnaire, based on available literature, Dietary Guidelines for Americans (USDA,2020), which is also the basis of mHEI-2015 used for the validation of this questionnaire, the following changes are proposed:

Correction of scoring for questions regarding fruit intake based on fruit intake guidelines8.

Addition of examples of included foods for each question considering the low education of the general population (Almiron-Roig et al., 2013). For example, the question about legume intake in the guidelines includes beans, lentils, chickpeas. Analysis of 7-day dietary records has shown that individuals do not know which foods belong to certain food groups.

Addition of seafood to the category of protein foods based on HEI-2015.

In the category of milk and dairy products, addition of calcium-fortified milk and dairy substitutes8 since it was noticed during analysis that participants underestimated intake within this group.

Following the example of HEI-2015 and mHEI-2015, addition of seeds to the category of nuts considering that they are also rich in omega-3 fatty acids.

Considering the recommendations8 on alcohol intake for adults, the response for the maximum number of points should be changed from < 1 glass to ≤ 1 glass. Suggested maximum points for this question is 2 points.

Due to the potential for better assessment of the frequency of weekly legume intake, it is proposed to formulate the legume intake question as how many times per week rather than how many plates per week. Responses < 1 time per week should be scored as 0 points, 1 - 2 times per week as one point, and ≥ 2 times per week as 2 points.

Symbols $>$ and $<$ should be replaced with $\geq$ and $\leq$ because it was observed that individuals with sufficient intake, for example, of fruit, i.e., those who consume two fruits daily, choose the response 1 - 2 fruits.

Following HEI-2015 scoring of different food groups, category of milk and dairy products, oils and fats, grains and processed meats should be scored 0, 2 and 4 points respectively.

The category of relationship with food is suggested to be excluded from scoring and determining overall diet quality but can be kept in the „Diet analysis" to help strategize future work with clients.

Table 3. Diet quality scores (%) for used methods.

Column1	Mean ± standard deviation	Confidence interval range (%)	
„Diet analysis" (DA)	53.2 ± 13.8	49.2	57.2
„Diet analysis" with proposed new scoring (DAn)	56.4 ± 16.4	51.6	61.1
mHEI- 2015 (mHEI)	69.1 ± 12.8	65.4	72.8

Paired t test didn't reveal significant difference between mean intakes form used methods ($P < 0.05$).

Table 4. Comparison of intake of food products. or nutritional values. for the corresponding questions of the „Diet analysis" and „Diet analysis" with proposed corrected scoring.

Nutritional habit / Nutrient intake	DA Intake (Median + IQR) of people scoring; OLD SCORING				DAn Intake (Median + IQR) of people scoring; NEW SCORING				
	0	1	2	P	0	1	2	4	P
How many vegetables do you consume daily?									
Vegetables (g/1000 kcal)	39.35 ± 27.60	97.64 ± 61.62	159.91 ± 176.72	< 0.05	39.35 ± 27.60	97.64 ± 61.62	159.91 ± 176.72	-	< 0.05
Dietary fibre (g/1000 kcal)	8.97 ± 5.03	11.96 ± 3.86	15.80 ± 9.13	< 0.05	8.97 ± 5.03	11.96 ± 3.86	15.80 ± 9.13	-	< 0.05
Vitamin C (mg/1000 kcal)	18.79 ± 42.08	49.46 ± 28.72	47.08 ± 117.89	0.74	18.79 ± 42.08	49.46 ± 28.72	47.08 ± 117.89	-	0.74
How many fruits do you consume daily?									
Fruit / fruit juice (g/1000 kcal)	17.97 ± 49.78	66.71 ± 57.02	183.09 ± 313.52	< 0.05	30.60 ± 59.24	0.00 ± 45.43	73.89 ± 82.50	-	< 0.05
Dietary fibre (g/1000 kcal)	9.75 ± 4.78	11.15 ± 3.62	15.46 ± 6.74	0.47	11.52 ± 2.45	7.84 ± 4.43	11.96 ± 5.01	-	0.65
Vitamin C (mg/1000 kcal)	34.08 ± 44.39	38.51 ± 37.50	61.94 ± 80.28	0.064	31.53 ± 28.62	36.20 ± 51.76	45.15 ± 37.73	-	0.62
How much protein rich foods do you consume daily?									
Protein rich foods (g/1000 kcal)	19.69 ± 14.50	52.71 ± 0.00	23.03 ± 11.85	< 0.05	19.69 ± 14.50	52.71 ± 0.00	23.03 ± 11.85	-	< 0.05
Protein (g/1000 kcal)	40.16 ± 10.51	52.71 ± 0	45.2 ± 7.85	0.91	40.16 ± 10.51	52.71 ± 0	45.2 ± 7.85	-	0.91
Fe (mg/1000 kcal)	7.17 ± 1.14	12.77 ± 0	7.26 ± 1.34	0.44	7.17 ± 1.14	12.77 ± 0	7.26 ± 1.34	-	0.44
Vitamin B12 (mg/1000 kcal)	1.91 ± 2.25	4.73 ± 0	2.62 ± 1.20	0.59	1.91 ± 2.25	4.73 ± 0	2.62 ± 1.20	-	0.59
How much dairy products do you consume daily?									
Dairy products/ fortified replacem. (g/1000 kcal)	144.73 ± 102.87	203. 01 ± 102.48	294.60 ± 33.85	< 0.05	144.73 ± 102.87	-	203. 01 ± 102.48	294.60 ± 33.85	< 0.05
Calcium (mg/1000 kcal)	360.76 ± 113.95	421.50 ± 171.09	523.80 ± 74.03	0.66	360.76 ± 113.95	-	421.50 ± 171.09	523.80 ± 74.03	0.66
Which type of oil do you mainly use for cooking?									
(PUFA+MUFA)/SFA (g/1000 kcal)	1.73 ± 0.71	2.24 ± 2.47	2.02 ± 0.72	< 0.05	1.73 ± 0.71	-	2.24 ± 2.47	2.02 ± 0.72	< 0.05
SFA (g/1000 kcal)	12.91 ± 3.53	10.81 ± 6.52	12.95 ± 2.40	0.78	12.91 ± 3.53	-	10.81 ± 6.52	12.95 ± 2.40	0.78
MUFA (g/1000 kcal)	14.34 ± 3.25	15.40 ± 15.62	18.05 ± 3.85	0.15	14.34 ± 3.25	-	15.40 ± 15.62	18.05 ± 3.85	0.15
PUFA (g/1000 kcal)	7.50 ± 4.26	8.40 ± 4.08	8.93 ± 2.36	0.83	7.50 ± 4.26	-	8.40 ± 4.08	8.93 ± 2.36	0.83

Table 4. Continued - Comparison of intake of food products. or nutritional values. for the corresponding questions of the „Diet analysis“ and „Diet analysis“ with proposed corrected scoring.

Nutritional habit / Nutrient intake	Intake (Median + IQR) of people scoring; OLD SCORING				Intake (Median + IQR) of people scoring; NEW SCORING				
	0	1	2	P	0	1	2	4	P
How much of your grains intake is wholegrains?									
Wholegrains (% of daily intake)	41.73 ± 26.68	47.96 ± 36.29	67.49 ± 24.77	< 0.05	41.73 ± 26.68	-	47.96 ± 36.29	67.49 ± 24.77	< 0.05
Dietary fibre (g/1000 kcal)	11.13 ± 4.81	10.59 ± 2.81	13.18 ± 4.98	0.29	11.13 ± 4.81	-	10.59 ± 2.81	13.18 ± 4.98	0.29
How much nuts do you consume daily?									
Nuts/seeds (g/1000 kcal)	2.03 ± 4.90	10.62 ± 17.09	13.44 ± 15.42	< 0.05	2.03 ± 4.90	10.62 ± 17.09	13.44 ± 15.42	-	< 0.05
Dietary fibre (g/1000 kcal)	10.34 ± 4.62	12.19 ± 5.22	15.8 ± 18.94	0.68	10.34 ± 4.62	12.19 ± 5.22	15.8 ± 18.94	-	0.68
How many alcoholic beverages do you consume daily?									
Alcohol (g/1000 kcal)	85.72 ± 115.26	0 ± 25.75	-	<0.05	85.72 ± 115.26	-	0 ± 25.75	-	<0.05
How much blue fish do you consume weekly?									
Blue fish (g/1000 kcal)	0 ± 11.24	10.77 ± 18.69	23.85 ± 28.13	< 0.05	0 ± 11.24	10.77 ± 18.69	23.85 ± 28.13	-	< 0.05
PUFA (g/1000 kcal)	8.19 ± 2.64	8.76 ± 4.12	9.17 ± 1.45	0.44	8.19 ± 2.64	8.76 ± 4.12	9.17 ± 1.45	-	0.44
How much legumes do you consume weekly?									
Legumes (g/1000 kcal)	0 ± 8.61	7.10 ± 7.63	11.26 ± 9.58	< 0.05	0 ± 8.61	7.10 ± 7.63	11.26 ± 9.58	-	< 0.05
Dietary fibre (g/1000 kcal)	10.54 ± 4.60	11.91 ± 6.50	11.26 ± 1.28	0.83	10.54 ± 4.60	11.91 ± 6.50	11.26 ± 1.28	-	0.83
How much processed meat do you consume weekly?									
Processed meats (g/ 1000 kcal)	22.26 ± 35.30	9.40 ± 9.06	4.01 ± 14.17	< 0.05	22.26 ± 35.30	9.40 ± 9.06	-	4.01 ± 14.17	< 0.05
Sodium (mg/1000 kcal)	1508.07 ± 608.48	1231.17 ± 734.34	1186.33 ± 900.97	0.76	1508.07 ± 608.48	1231.17 ± 734.34	-	1186.33 ± 900.97	0.76

**P – Kruskal-Wallis test (significance level 5%)*

Conclusions

In summary, our study has demonstrated the relative validity of the newly developed “diet analysis” tool in assessing dietary quality among participants. Through a rigorous comparison with the established mHEI-2015, we have identified areas where the “diet analysis” performs well and areas where refinement is needed. Our findings underscore the importance of continuous validation and improvement of dietary assessment tools to ensure their accuracy and reliability in clinical practice.

The recommendations proposed based on our analysis offer practical steps to enhance the validity and usability of the “diet analysis” tool. By incorporating specific dietary guidelines, providing examples of food items, and refining language and response options, we can improve the relevance and clarity of the questionnaire. Additionally, considering the inclusion of new categories, such as seafood and fortified dairy substitutes, can provide a more comprehensive assessment of dietary intake. Moving forward, further validation studies with larger and more diverse populations are warranted to strengthen the reliability of the “diet analysis” tool. Longitudinal studies assessing its predictive validity and responsiveness to dietary interventions could provide valuable insights into its utility for clinical practice. Collaboration with healthcare professionals and researchers from diverse backgrounds can facilitate the development of culturally sensitive and contextually relevant dietary assessment tools. The corrected version of the “diet analysis” tool holds promise for use in clinical practice, serving as a valuable resource for nutrition counselling and dietary intervention programs. By aligning with established dietary guidelines and incorporating recommended changes, the tool can effectively support healthcare professionals in assessing and addressing the dietary habits of their clients.

In conclusion, our study contributes to the ongoing efforts to advance dietary assessment methodologies and promote evidence-based nutrition counselling practices. By leveraging innovative tools like the “diet analysis” and integrating them into routine clinical care, we can empower individuals to make informed decisions about their dietary habits and improve their overall health and well-being.

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