Psychometric Properties of the Hungarian Version of the Iowa Infant Feeding Attitude Scale

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Abstract

Background: The Iowa Infant Feeding Attitude Scale (IIFAS) is a widely used tool to assess attitudes toward infant feeding methods. Attitudes toward breastfeeding are one of the main influencing factors of feeding choice and breastfeeding duration. Adaptation of IIFAS to Hungarian provides an opportunity for cross-cultural comparisons and helps targeting breastfeeding support interventions.

Methods: The original IIFAS was translated into Hungarian and back-translated to English. A cross-sectional study was conducted among 553 mothers whose latest child's age was between 6 and 36 months. In addition to the Hungarian IIFAS, infant feeding status and socioeconomic properties were self-reported in the online survey. Psychometric properties, validity and internal consistency were determined and compared with international results.

Results: The 17 item IIFAS-H showed good psychometric properties with that of Cronbach alpha=0.733. Further analyses proved that two shortened versions of the IIFAS-17 consisting of 11 and 9 items also showed good properties (Cronbach's alpha=0.789, 0.787). After comparing our results to the international short versions of IIFAS, we found that they share 8 identical items. These common 8 items have similar good properties with the Cronbach's alpha=0.763.

Conclusions: The benefits of possible use of international comparisons of the 8-item version outweigh its slightly lower reliability compared to the 9 or 11-item versions. Based on our analyses, we suggest the use of the 8-item-long, shortened version (IIFAS-H8) of the scale.

Background

Recent statistics in Hungary show that the rates of exclusive breastfeeding are significantly lower (1) than recommended by the World Health Organisation (i.e. exclusive breastfeeding for six months, and then the gradual introduction of complementary foods while continuing breastfeeding for two years of age or beyond on demand of the child and the mother) (2). The majority of the mothers (95%) initiate breastfeeding; However, 3-4 days later, just after hospital emission, these data lay below expectations with only 53% exclusive breastfed infants. In Hungary's capital, Budapest, the formula supplementation happens in the early postpartum days in 40% of cases without medical indication initiated purely by the mother (2). Based on the health visitor nurse statistics, the exclusive breastfeeding rate was 35% in 2018 at 6 month of age, while a new cohort study conducted by the Hungarian Central Statistical Office shows only 17% exclusive breastfeeding at this age (1).

Families in Hungary which need or choose infant formula for their infant are able to access it for its full price or purchase it with medical prescription for a half price during the first six months of the child's age. The official and open database of the Hungarian Health Insurance Provider NEAK reveals a gradual increase over the past years of normal infant formula amounts prescribed by doctors.. (3)

It would be important to gather accurate information about the causes of this worldwide tendency and develop a national strategy to improve exclusive breastfeeding rates and overall breastfeeding duration.

According to previous studies (4) (5) (6), initiation and duration of breastfeeding is influenced by the following factors: socioeconomic status; education; age; ethnicity; family support, breastfeeding relatives and friends, value of breastfeeding within the closer community; breastfeeding support in the society: maternity leave, paid maternity leave, breastfeeding protection in the workplace; restriction of formula marketing based on the WHO Code of breast milk substitutes (7) and subsequent resolutions of WHA; breastfeeding support in medical facilities; maternal attitude; breastfeeding knowledge, and access to information.

The degree of the influence of these factors on breastfeeding duration is controversial. Since the introduction of Ajzen's Planned Behaviour theory (8) maternal attitude is seen as one of the most significant factors attributable to breastfeeding initiation and duration. Behavioral attitudes comprehend the individual's perception of the positive and negative effects of the chosen behavior, the expected cost and benefits.

Measuring attitudes toward breastfeeding

The investigation of attitudes toward infant nutrition has not been conducted within Hungary before. Since 1991, several measuring scales have been developed worldwide to measure breastfeeding attitudes, knowledge, and community support. These were recently collected and analyzed by Corinne Casal et al. (9). Sixteen measuring devices were found to meet the set criteria. One of the first widely used measures of breastfeeding attitudes with a high predictive value is the *Breastfeeding Attraction Prediction Tool* (BAPT) scale published in 1992 (10). The biggest limitation of its applicability is that it consists of 94 items, so the data acquisition takes about 30-35 minutes. The most commonly used tool for measuring infant feeding attitudes is the *Iowa Infant Feeding Attitude Scale* (IIFAS) introduced in 1999 was developed by Adele de la Mora et al. (11). The purpose of the 17-item, short question series is to measure attitudes and knowledge about infant nutrition. Using this scale will make it possible to find mothers who may need targeted breastfeeding support.

The development and validation process of the instrument was described by De la Mora and Russel, who also made the scale eligible and described the methodology of assessment (11). The study describes the process of the IIFAS development. In the process of developing the scale, 26 questions were initially applied aiming at two main topics and to be answered on a five-point Likert scale:

Product dimensions of breastmilk and formula: cost, maternal physical condition, sexual aspects, mental-physical comfort, nutritional dimensions

Process dimensions of breastfeeding and formula feeding: parental role, physical proximity, infant food intake, ease and accessibility of feeding, nocturnal feeding

- Items of the final IIFAS scale were selected on the basis of the rank order of 26 attitude questions. The 26-item version was too time consuming and difficult, particularly for women with lower socioeconomical status and education.
- The obtainable scores are between 17 and 85 within the scale narrowed to 17 items, where 17 indicates the attitude in favor of formula feeding. Content and consistency validity has not been examined by De la Mora. However, predictive validity was checked by Mora with several data sets, and the results revealed that the measured attitude towards infant feeding predicted the chosen infant feeding method.

IIFAS in other cultures

Since the scales analyzed in Casal's meta-analysis (9) are, with a few exceptions, developed within the United States, a relevant question is to be answered whether they are suitable for measuring attitudes toward infant feeding in other cultures, as well. IIFAS has also been highly prioritized compared to other scales published in the pertaining literature. Cronbach's alpha coefficients were reported ranging between 0.5 and 0.89. Higher attitude scores in all studies correlated with attitudes in favor of breastfeeding and lower attitudes in favor of formula feeding, while they even predicted or were specifically associated with the choice of feeding in pregnant women.

In the Arabic version of the IIFAS scale (12) the 8th item about breastfeeding in public places and the 17th item about maternal alcohol consumption had both very low corrected item-total correlations (CITC). The behavior of both items can be well explained by the mostly typical attitudes of Arab cultures toward alcohol consumption and public statements of intimacy; however, during the validation procedure the scale performed well and its predictive value proved to be adequate. The data extracted from the sample of Lebanese women that has been referred to produced results that favored essentially formula nutrition. The IIFAS score correlated solely with the number of breastfed children. The examined sample also showed a correlation already proven by other investigators (13) that higher maternal age reduces breastfeeding rates, contrary to the tendencies observed in the United States and Europe.

The Japanese scale (14) was also prepared by two independent research groups, but only its second version was back translated and only then it was detected that some relevant nuances of the translation had been inadequate. Following the correction, items 5 and 10 on overdose were omitted from the questionnaire, arguing that Japanese mothers are not particularly concerned with overfeeding their infant but were more anxious about not providing sufficient nutrition to their child.

The mainland Chinese study of Dai et al (15) supports the fact that in mainland China the rates of exclusive breastfeeding during the first days in hospital are very low, but increase after emission. In western countries the findings are the opposite, such as, exclusive breastfeeding rates are high in the first days after delivery, but decrease over time. (16)

Although several analyses have attempted to explore the internal structure of scales measuring breastfeeding attitudes, the exploratory factor analysis has found different factor numbers in different

studies.

One possible explanation according to the research of Lau et al in Singapore (17) is, that differences in factor structure may be based on different perceptions and attitudes toward breastfeeding. This can further explain why in some research papers (14) (18) the construct validity is so low. Inoue states that the IIFAS did not contain any specific items related to breastfeeding in Japan, and there is no further explanation to this highly interesting topic (14). This explanations are further established by the Value theory of Hofstede: as a shared national heritage is “an important determinant of cultural similarity” (19). Despite the fact that breastfeeding is a global, general womanly/maternal experience around the world, there are many differences in details and attitudes between cultures and nations.

Findings in Europe

Scott and colleagues investigated expectant couples' infant feeding attitudes in Glasgow and its association with postnatal feeding (20). Maternal feeding attitudes, as measured by IIFAS, showed a stronger correlation with the chosen feeding method than with socioeconomic parameters.

Parental attitudes of formula-feeding couples did not differ, but IIFAS scores of breastfeeding mothers was higher than their partners'.

Scott and colleagues also applied IIFAS during their interviews in four European countries: Sweden, Italy, Spain and Scotland (21). The largest difference between the responses was given during the assessment of item 8 (public breastfeeding). The researchers concluded that the duration of breastfeeding is more significantly influenced by country-specific social norms rather than maternal attitudes. High breastfeeding periods in Sweden were associated with widespread acceptance of public breastfeeding, while in Italy and Scotland low acceptance of public breastfeeding was associated with very low breastfeeding periods.

Wallis et al's study (18) was the first validation process of the IIFAS scale in Eastern-Europe. The Romanian IIFAS scale shows that some aspects of infant feeding attitude change over time. Expectant mothers were more dismissive toward breastfeeding in public than postpartum mothers. IIFAS-R scores were in the neutral range in both groups, and in comparison to other researches the internal consistency was relatively low with Cronbach's alpha 0.50 in the expectant mother's group and 0.63 in the maternity group.

Sittlington (22) used an English-language IIFAS scale in his research in Northern Ireland. At the same time, he simplified the clause of the first item in the original scale, that is, 'The nutritional benefits of breast milk last only until the baby is weaned from breastmilk'. Thus, the Northern Irish version of the item was altered (i.e. "The benefits of breastmilk last only as long as the baby is fed"). As a result, it can be stated that content simplifications make the question easier to answer even in lower-educated populations, thereby increasing the reliability of the scale.

In a Croatian study, a questionnaire measuring breastfeeding knowledge and attitudes (23) was completed by health workers as participants of the WHO UNICEF Baby-Friendly Hospital course before enrollment and three months after its completion in order to determine the impact of the course on participants' attitudes and knowledge. The IIFAS scale was used to measure the participants' attitude toward breastfeeding. The IIFAS scale was also used to measure the breastfeeding attitudes of nurses working at NICU, with an average score of 69, that was interpreted as a positive attitude toward breastfeeding (24). Thus, the IIFAS scale, in line with the findings of other scientific investigations, is not only suitable for assessing the infant feeding attitudes of pregnant women and mothers, but can also be used for this purpose in the case of professionals and volunteer helpers.

Shortened versions of the IIFAS

In different research publications conflicting evidence has been shown on reliability of the scale. Cronbach's alphas ranged between 0.50 (18) and 0.89 (25), but, as Tomas-Almarcha noted (26), this was not explained. Evidence is also conflicting on factor structure. This indicated the search for solutions with better reliability. One possible solution is to eliminate items which have a low CITC if the Cronbach's alpha were higher as a result. Furthermore, shorter versions of the original scale are less time consuming and make it better applicable as part of complex researches in the field of human lactation. The intentions behind abbreviating original scales or items to compare the results of the original scale with their abbreviated versions at all instances.

Statistical analyses focused on items which influenced the internal consistency and predictive validity negatively while the corrected item total correlation was low.

AlKusayer et al (27) were the first who compared the predictive validity of the 17 items IIFAS with the shortened 13- item version among pregnant women. They found a similar internal consistency of both, the Cronbach's alpha was 0.870 in shorter versions. The 13-item IIFAS has been found to have good psychometric properties. Instead of the original two factors they proposed a re-categorisation into three factors such as favorable to breastfeeding, favourable to formula feeding and convenience. However, when reducing the items, it was not only the results of the statistical analysis that were taken into account. Item 8 ('Women should not breast-feed in public places such as restaurants'), for instance, was retained despite its low predictive validity. However, it was known from the results of previously conducted qualitative research that acceptance of public breastfeeding strongly influences breastfeeding propensity. As a final step, items 4 ('Breast milk is lacking in iron'), 11 ('Fathers feel left out if mother breast feeds'), 16 ('Breast milk is less expensive than formula') and 17 ('A mother who occasionally drinks alcohol should not breast-feed her baby') were removed from the scale. It has been decided that special knowledge is required to answer the questions 4 and 17. In the case of the latter, enquiring about alcohol consumption the corrected item total correlation has been found to be low in several other studies. In the case of item 16, the respondents' agreement was almost unanimous; therefore, this item did not prove suitable for differentiation between different respondent attitudes. For item 11, the responses did not affect the breastfeeding intention and mode of infant feeding.

In Nanishis et al's study (28) the Japanese version of the scale, IIFAS-J score was not significantly associated with exclusive breastfeeding rates at 4 and 12 week-long postpartum. None of the items show a higher CITC than 0.39 with Cronbach's alpha 0.66. Due to negative factor loading of item 17, it was removed, and one item was changed to a more polite wording: instead of 'Mothers who formula-feed miss one of the great joys of motherhood', they used the wording 'Breastfeeding is one of the joys of motherhood' (7). Surprisingly, results of this study may origin not only in possible errors of translation but also in diverse cultural circumstances and different ways of thinking, as mentioned above (14) (19).

As result, Cronbach's alpha of the 17- item version grows from 0.726 to 0.79 in the 9 item version of IIFAS-S. The IIFAS9-S fits in a one dimensional model as shown by confirmatory factor analysis. Thomas-Almacha et al proposed for the 9-item-long Spanish scale a cut-off score of 32 for primiparous and of 31 for multiparous women, as equal or lower scores indicate a breastfeeding promotion intervention. This can be a practical purpose for calculating cut-off scores, as shown in other research publication (12, 18).

In the Iranian version of IIFAS (IIFAS-I) 6 questions were removed due to low loading factors less than 0.3. Two from the six are the same, which had the lowest CITC in the Arabic research: items 8 and 17, that is, breastfeeding in public places and alcohol consumption, seem to be inadequate questions inmost Muslim countries. The other four questions asked for special breastfeeding knowledge. The authors state that the low loading factors indicate an insufficient breastfeeding knowledge in the measured population, where more than the half of the expectant mothers attended a breastfeeding course during pregnancy. The created 11-item IIFAS-I showed good internal consistency and acceptable loading factors for all remained items.

Table 1 Shortened versions of the IIFAS-scale

Research	Study design	Cronbach's alpha of the 17 item scale	Mean	Items left out	Cronbach's alpha of the shortened scale
Tomás-Almarcha 2016 Spain (26) IIFAS-S	Convenience sample 1354 pregnant women, prospective	0.726	66.12	9 item 1, 4, 5, 8, 10, 11, 16, 17	0.792
AlKusayer 2018, Canada (27)	Cross-sectional, 1238 pregnant women	?		13 item 4, 11, 16, 17	0.868
Nanishi 2014, Japan (28) IIFAS-J	Longitudinal, 781 pregnant women	?	61.04	16 items (5,) 17 removed	0.66
Ghasemi 2018, Iran (29) IIFAS-I	Cross-sectional, 280 breastfeeding mothers	not reported	neutral (49-69)	11 items: 1, 4, 5, 8, 10, 17 items removed due to loading factor less than 0,3	0.856
Charafeddine 2016 (12) IIFAS-A Ország?	Cross-sectional, convenience sample, 196 Arab women, pregnant or peer counselors	0.64	37-85, 72.4% neutral (60-75) attitude	ITC less than 0.3 in 8 (0.053), 17 (0.008), but items were not removed	0.693
Dai 2013, China (15)	Convenience sample of 660 post partum women, prospective	0.722		ITC less than 0.3 in 6, 10, 17, but items were not removed (0.262-0.691)	0.76
Ying Lau Singapore (17) 2016	cross sectional, 417 multi-ethnic, English speaking pregnant women	not reported	different between ethnic groups, 62-57	5, 17 below 0.3, but items were not removed	0.79

Methods

Aim

Our paper is the first cross-sectional study for the adaptation of the Iowa Infant Feeding Attitude Scale into Hungarian. Besides describing the psychometric properties, such as, validity and internal consistency of our scale, we compared our data with international results. Further aims of our research within our sample of postpartum women were assessing breastfeeding attitudes along with breastfeeding duration and sociodemographic factors..

Design

Data collection was realised with the aid of an online internet survey provider, named *kerdoivem.hu*. After the addition of items aiming at the extraction of the respondents' demographic data and breastfeeding attitudes to the scale, the measure was used for a survey in April 2019. Our sample proved to be a convenience sample due to the fact that the invitation for participation and the link of the questionnaire was supplemented with a brief summary of the research objectives and conditions of participation and were circulated on both the mother-baby group mailing list and on social media, besides the specific groups concerned with breastfeeding support, by-nutrition, and mothers who gave birth with cesarean section. However, the questionnaire was allowed to be completed once from the same IP address. The completion of the scale was anonymous, while respondents were warned about the electronic storage of their data that is in compliance with the regulations pertaining to personal data storage.

Although the original inclusion criteria did not indicate a Hungarian address as a condition, based on the respondents' postal code provided in the answers, the data of respondents residing outside Hungary were excluded from our pool of 638 aggregated fill-out data. The reason for this was that their attitudes towards breastfeeding might be influenced by different factors than that of the Hungarian population. Taking into account further additional aspects related to the respondents (i.e. the respondent must be older than 18 but under 49 years of age, or have a child between 6 and 36 months of age), as a final step, only the responses of women were analyzed out of the responses of 553 women and 1 man.

Measures

Two authors of this article parallelly translated the original 17-item IIFAS into Hungarian in 2018, and after their consensus an independent, bilingual translator who was not familiar with the instrument, translated it back to English. Since the backtranslation and the original version had showed no significant differences, the wording of the Hungarian scale was finalized.

The IIFAS scale is composed of 17 items that are rated on a 5-point Likert scale (ranging from 1 strongly disagree – 5 strongly agree). Eight items are favourable toward breastfeeding, nine items toward formula

feeding that are reverse coded. The total score ranges from 17 to 85, where the lower score indicates a more positive attitude toward formula feeding.

Participants completed the 17 item IIFAS scale, and were asked for providing demographic data such as income, living place, education and infant feeding status in different ages (1, 4 and 6 months of age) of their youngest child aged 6-36 months as asked for by De La Mora (11). We monitored for the feeding status with the following question:

“How were you feeding the baby at 1 (4, 6) months of age?” Answers on a 5-point scale:

1: exclusive breastfeeding 2: breastfeeding with little formula supplementation 3: approximately half breastfeeding, half formula feeding 4: mainly formula, little breastfeeding 5: exclusive formula feeding.

Characteristics of participants

The 553 participant women ranged in age from 21 to 47 years (M=32.88 years, SD=4.84). Our sample consists of mostly well educated women: 70% of participants had completed at least college or higher education. 63% of participants are first time mothers, 23,9% have two children, and 12,3% have three or more children. On the basis of monthly family income, 38,3% of participants have low income, 37,4% a middle range income, and 24,2% have a high income. 22.8% of participants are currently working. 64.7% of mothers were breastfeeding their youngest child in the time of the questionnaire completion. 70% of mothers were still exclusively breastfeeding when the youngest child was 6 months old. This indicates that in our sample breastfeeding mothers are overrepresented. Current Hungarian research results (1, 2) and data show a much lower rate for breastfeeding, such as between 35%-17% for exclusive breastfeeding at 6 months. Descriptive characteristics of the sample is shown in detail on Table 2.

Table 2 Sociodemographic characteristics of the sample

Variable	<i>n</i> (%)
Maternal age	
21-29 years	150 (27.1)
30-39 years	350 (63.3)
40-47 years	53 (9.6)
Parity	
one child	349 (63.1)
two children	132 (23.9)
more than two children	68 (12.3)
Level of education	
primary	20 (3.6)
secondary	107 (19.3)
university	426 (77.0)
Monthly income	
low income	212 (38.3)
middle range income	207 (37.4)
high income	134 (24.2)

Data analysis

All statistical analyses were performed using the IBM SPSS Statistics for Windows, Version 25. Descriptive analyses of sociodemographic characteristics of the participants and the scores of the IIFAS were carried out. Cross-tabulations were used to determine to what extent the type of feeding in an earlier date determines the type of feeding when the infant is already older.

Reliability of the translated 17-item IIFAS and the shortened scales was assessed using Cronbach's *alpha* coefficient, estimation of *alpha* when an item was deleted from the scale, and corrected item-total correlation (CITC). The correlation between the independent variables (sociodemographic variables and the infant feeding status at 4 and 6 months of age) and the IIFAS scores was evaluated by Spearman's *rho* (rank correlation), except for the correlation between the age of the respondents and the IIFAS scores where Pearson's *r* was applied.

To evaluate construct validity, we performed a principal component analysis, forcing the extraction of one principal component (factor). Scree plot and the factor loadings were assessed. In order to obtain a shorter version of the scale, we were deleting items with a CITC or factor loading of less than 0.3.

To determine predictive and incremental validity, hierarchical logistic regression analyses were conducted to evaluate whether attitudes toward infant feeding could influence the actual type of feeding method when the infant was 4 and 6 months old, over and above the effects of the sociodemographic variables. The dependent variables of the two analyses were the binary variables of the exclusive breastfeeding at both of the given dates. The sociodemographic variables (maternal age, maternal education, number of biological children) were entered first into the regression equation, followed by scores of IIFAS. Significance of the models, Nagelkerke's R^2 and odds ratios (OR) were calculated.

All results were considered significant when , except for the cases where a special value of *p* is given.

Results

Hungarian version of IIFAS with 17 items

The Cronbach's *alpha* coefficient of the IIFAS-H was 0.733. Table 3 shows beside the basic statistics (mean and standard deviation) the CITCs and Cronbach's *alpha* values when an item was deleted. The last column of this table shows the factor loadings of the first principal component.

Table 3 Basic statistics and main results of reliability analysis and principal component analysis forcing one factor for the IIFAS-H (n=553).

	Mean	St.Dev.	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Factor Loading
1.* The nutritional benefits of breast milk last only until the baby is weaned from breast milk.	2.92	1.757	0.050	0.759	0.070
2.* Formula-feeding is more convenient than breast-feeding.	4.17	1.249	0.372	0.716	0.452
3. Breast-feeding increases mother-infant bonding.	4.57	0.915	0.506	0.709	0.645
4.* Breast milk is lacking in iron.	3.83	1.109	0.142	0.736	0.164
5. Formula-fed babies are more likely to be overfed than are breast-fed babies.	3.50	1.442	0.456	0.706	0.634
6.* Formula-feeding is the better choice if a mother plans to work outside the home.	3.62	1.295	0.373	0.716	0.448
7. Mothers who formula-feed miss one of the great joys of motherhood.	2.71	1.453	0.435	0.708	0.604
8. Women should not breast-feed in public places such as restaurants.	4.36	1.075	0.328	0.720	0.398
9. Babies fed breast milk are healthier than babies who are fed formula.	3.42	1.398	0.486	0.703	0.677
10.* Breast-fed babies are more likely to be overfed than formula-fed babies.	4.55	0.837	0.304	0.724	0.375
11.* Fathers feel left out if a mother breast-feeds.	4.07	1.162	-0.004	0.749	-0.016
12. Breast milk is the ideal food for babies.	4.92	0.419	0.221	0.731	0.327
13. Breast milk is more easily digested than formula.	4.44	1.002	0.457	0.711	0.627
14.* Formula is as healthy for an infant as breast milk.	3.67	1.272	0.539	0.699	0.682
15. Breast-feeding is more convenient than formula-feeding.	4.08	1.232	0.498	0.704	0.597
16. Breast milk is less expensive than formula.	4.65	0.911	0.161	0.733	0.226
17.* A mother who occasionally drinks alcohol should not breast-feed her baby.	3.26	1.487	0.284	0.726	0.382
* Items marked with asterisks are reverse-scored to show a positive attitude toward breastfeeding.					

Figure 1 shows the scree plot of the principal component analysis. It gives support to forcing the extraction of one principal component. However, due to the low factor loadings (less than 0.3 in Table 3), four items (Item 1, 4, 11 and 16) can be considered as problematic. For these four and for two other items (item 12 and 17) the CITC is also under 0.3.

Nevertheless, the convergent validity of the 17-item scale can be supported by the correlations between IIFAS score and other investigated variables (sociodemographic variables and ones concerning the infant feeding status which are significant (*Table 2*). The correlation with the type of infant feeding at different ages are not only significant but also not too weak.

Table 4 Correlation of the given variables with the Hungarian version of IIFAS (n=553).

	Correlation*	p
maternal age	0.118	0.005
maternal education level	0.215	0.000
number of biological children	0.112	0.009
infant feeding status at 1 months of age	0.358	0.000
infant feeding status at 4 months of age	0.470	0.000
infant feeding status at 6 months of age	0.553	0.000
* Spearman's rank correlation except for maternal age, at which Pearson's <i>r</i> is given.		

The 17-item IIFAS scores of the 553 respondents ranged from 37 to 85 with a mean of 66.76 and standard deviation of 9.000. Table 5 shows the descriptive statistics of the IIFAS scores in three versions of splitting concerning the answers of the respondents to the question about the infant feeding status at 3 different ages.

Table 5 Descriptive statistics of IIFAS scores in the groups formed by the answers of the respondents about infant feeding status at different ages (n=553).

Infant feeding status at 1 months of age	N	Mean	Std. Deviation	Minimum	Maximum
exclusive breastfeeding	416	68.62	7.749	43	85
breastfeeding with little formula supplementation	65	65.28	9.355	37	83
about 50-50% breastmilk and formula	29	60.41	10.280	40	77
mainly formula with little breastmilk	28	56.68	8.331	41	77
exclusive formula feeding	15	52.60	7.337	41	66
Infant feeding status at 4 months of age					
exclusive breastfeeding	414	69.35	6.971	49	85
breastfeeding with little formula supplementation	41	65.61	8.927	48	83
about 50-50% breastmilk and formula	13	59.69	8.321	43	77
mainly formula with little breastmilk	21	57.14	7.631	40	66
exclusive formula feeding	64	55.28	9.424	37	76
Infant feeding status at 6 months of age					
exclusive breastfeeding	386	69.96	6.624	50	85
breastfeeding with little formula supplementation	44	66.07	8.159	50	83
about 50-50% breastmilk and formula	21	60.48	8.340	49	78
mainly formula with little breastmilk	15	59.93	6.170	41	69
exclusive formula feeding	87	55.60	8.827	37	75

One can see from Table 5 that the majority of the respondents preferred exclusive breastfeeding. Almost 70% of them breastfed their infant exclusively even at 6 months of age. The main trends of the mean values harmonize with the expectation that greater IIFAS score shows a more positive attitude towards breastfeeding and it has a higher level at the mothers who breastfeed for a longer time. But it is important to emphasize that there was movement between the groups into both directions during the investigated time-period. From the cross-tabulations (not shown here) it can be seen, for instance, that 34 from the 386 mothers who breastfed their child exclusively when the infant was 6 months old, used to give more or less formula to their infant when he/she was 1 month old.

First hierarchical logistic regression was carried out with the dependent variable of the exclusive breastfeeding when the infant was 4 months old (1 = yes, 0 = no). The first block of the 3 sociodemographic variables as predictors gave a significant model ($\chi^2(6) = 21.7, p=0.0014$) but only the number of the biological children was significant ($OR=1.507, p=0.011$) and the explanatory power of the model was quite low (Nagelkerke's $R^2=0.057$). After entering the second block containing only the IIFAS score as a predictor the model substantially improved. Both the difference of the models ($\chi^2(1)=127.2, p=0.000$) and the second model ($\chi^2(7)=148.9, p=0.000$) were significant. The OR of the number of the biological children was weaker than in the first model ($OR=1.403, p=0.070$) but the OR of the IIFAS score was significant ($OR=1.157, p=0.000$). Thus, the explanatory power of the model became much higher (Nagelkerke's $R^2=0.351$).

At the second run of the hierarchical logistic regression the dependent variable was 'the exclusive breastfeeding at 6 months of age (1 = yes, 0 = no)'. The results in general were very similar to the first run with the 4-month-focused data. The first block of the 3 sociodemographic variables gave a significant model ($\chi^2(6) = 19.8, p=0.003$) but only the number of the biological children was significant ($OR=1.462, p=0.010$) and the explanatory power of the model was low (Nagelkerke's $R^2=0.050$). After entering the IIFAS score, the model substantially improved here, as well. Both the difference of the models ($\chi^2(1)=159.7, p=0.000$) and the second model ($\chi^2(7)= 179.5, p=0.000$) were significant. The OR of the number of the biological children was weaker than in the first model ($OR=1.346, p = 0.090$), but the OR of the IIFAS score was significant ($OR=1.179, p=0.000$). The explanatory power of the model became much higher (Nagelkerke's $R^2=0.395$).

These results show that over and above the sociodemographic variables the IIFAS score could give substantial information on predicting whether a mother will breastfeed her child exclusively at 4 or 6 months of age.

Possible shortened forms of Hungarian version of IIFAS

If we expect a scale in which each item should have a CITC and factor loading in the first principal component at least 0.3, then we get a shortened form of Hungarian IIFAS which consists of 11 items. As it was mentioned above, items 1, 4, 11, 12, 16 and 17 must be deleted from it since all of these six items have a CITC less than 0.3. In addition, four of them should be deleted because of the low factor loadings, as well.

This 11-item version of the scale has better characteristics than the 17-item scale (e.g. its Cronbach's alpha is 0.789 and all the factor loadings of the first principal component are greater than 0.3) but the CITC of two items (item 8 and 10) is a little under 0.3 (0.292 and 0.291). If we use again the rule mentioned earlier, these items have to be deleted and we get a 9-item version of IIFAS. If we compare the items of this version with other shortened forms of IIFAS from different cultures and languages (Canadian 13 item version (27), Iranian 11 item version (29), Spanish 9 item version (26)) we can declare that 8 items are common in these four shortened forms. The additional item of the Hungarian 9-item

version includes the statement about overfeeding (“Breast-fed babies are more likely to be overfed than formula-fed babies.”). Table 6 gives an overview about the items of the different shortened forms.

Table 6 Recommended shortened forms of IIFAS in different cultures based on the literature and this study

	Canadian	Iranian	Spanish	Hungarian (11 items)	Hungarian (9 items)
1.* The nutritional benefits of breast milk last only until the baby is weaned from breast milk.	x				
2.* Formula-feeding is more convenient than breast-feeding.	x	x	x	x	x
3. Breast-feeding increases mother-infant bonding.	x	x	x	x	x
4.* Breast milk is lacking in iron.					
5. Formula-fed babies are more likely to be overfed than are breast-fed babies.	x			x	x
6.* Formula-feeding is the better choice if a mother plans to work outside the home.	x	x	x	x	x
7. Mothers who formula-feed miss one of the great joys of motherhood.	x	x	x	x	x
8. Women should not breast-feed in public places such as restaurants.	x			x	
9. Babies fed breast milk are healthier than babies who are fed formula.	x	x	x	x	x
10.* Breast-fed babies are more likely to be overfed than formula-fed babies.	x			x	
11.* Fathers feel left out if a mother breast-feeds.		x			
12. Breast milk is the ideal food for babies.	x	x	x		
13. Breast milk is more easily digested than formula.	x	x	x	x	x
14.* Formula is as healthy for an infant as breast milk.	x	x	x	x	x
15. Breast-feeding is more convenient than formula-feeding.	x	x	x	x	x
16. Breast milk is less expensive than formula.		x			
17.* A mother who occasionally drinks alcohol should not breast-feed her baby.					
* Items marked with asterisks are reverse-scored to show a positive attitude toward breastfeeding.					

All the analyses which were applied to investigate the 17-item Hungarian version of IIFAS were run also for each of the 11-item, the 9-item and the 8-item scales. For the 9-item and 8-item scales all the CITCs and factor loadings are already above 0.3 (and what is more the minimum values of factor loadings were 0.415 and 0.475, respectively). All the other statistical parameters of these scales were as good as or better than the ones of the 17-item version. The most important statistical results are summarized in Table 7.

Table 7 Main statistical results when analysing the three shortened forms of Hungarian version of IIFAS (n=553)

	Hungarian versions of IIFAS		
	11 items	9 items	8 items
Cronbach's alpha	0.789	0.787	0.763
Correlation ^a of IIFAS score with...			
maternal age	0.123 (p=0.004)	0.120 (p=0.005)	0.122 (p=0.003)
maternal education level	0.172 (p=0.000)	0.176 (p=0.000)	0.151 (p=0.000)
number of biological children.	0.074 (p=0.083)	0.065 (p=0.129)	0.067 (p=0.106)
feeding status at 1 months of age	0.375 (p=0.000)	0.376 (p=0.000)	0.354 (p=0.000)
feeding status at 4 months of age	0.492 (p=0.000)	0.492 (p=0.000)	0.467 (p=0.000)
feeding status at 6 months of age	0.560 (p=0.000)	0.558 (p=0.000)	0.523 (p=0.000)
Results of hierarchical logistic regression			
if dependent variable is exclusive breastfeeding at 4 months of age			
Nagelkerke's R ² of the first model ^b	0.057	0.057	0.057
Nagelkerke's R ² of the second model ^c	0.388	0.396	0.367
OR of IIFAS score in the second model ^c	1.204	1.230	1.245
if dependent variable is exclusive breastfeeding at 6 months of age			
Nagelkerke's R ² of the first model ^b	0.050	0.050	0.050
Nagelkerke's R ² of the second model ^c	0.436	0.440	0.408
OR of IIFAS score in the second model ^c	1.236	1.264	1.279
^a Spearman's rank correlation except for maternal age, at which Pearson's <i>r</i> is given.			
^b Using maternal age, maternal education level and number of biological children as predictors			

Discussion

Our main hypothesis was that exclusive breastfeeding maternal behavior until six months of age of the infant will be associated with a high IIFAS score (i.e. a breastfeeding-favoring attitude), while in the case of mothers who are exclusively or predominantly formula feeding at the child's six months of age, their IIFAS score will remain in the lower ranges. This assumption was confirmed on the grounds of the examined sample. Our results indicate that, similar to other studies, the IIFAS17-H is predictive of actual feeding behavior and breastfeeding duration in a Hungarian sample.

We also hypothesized that a higher IIFAS score was associated with higher education, number of children, and age. Although this correlation was demonstrated in our sample, more research is needed on a more heterogeneous or representative sample to better interpret the relationship between breastfeeding and demographic factors.

In our research we observed a similar tendency to Dai's data (15), that exclusive breastfeeding rates *increase* over time. Interestingly, in western countries the tendency is mostly the opposite. Dai explain this fact with not enough breastfeeding support in the health facilities. This can be a good explanation for our results as well because of high supplementation rates in the first days of postpartum (2) despite the overall breastfeeding-friendly attitude of mothers.

Although the suitability/reliability of IIFAS for measuring breastfeeding attitudes is unquestionably based on research to date, it typically has some inherent weaknesses.

Our results revealed a low CITC value of the following items: 1. ('The nutritional benefits of breast milk last only until the baby is weaned from breast milk.'), 4. ('Breast milk is lacking in iron'), 11. ('Fathers feel left out if a mother breast-feeds'), 12. ('Breast milk is the ideal food for babies.'), 16. ('Breast milk is less expensive than formula.') and 17. ('A mother who occasionally consumes alcohol should not breast-feed her baby').

Even the authors of the IIFAS scale ponder about the theoretical question of whether the scale really does measures attitudes or rather just beliefs. For instance, in the case of question 4 the vast majority of respondents are not in the possession of the knowledge of the amount of iron measured in breast milk and whether it is present at all. Furthermore, the expression used in the questionnaire of *lacking in iron* makes mothers more insecure in relation to this matter since they would require factual figures as a benchmark for their balanced answer. However, if we measure beliefs, a respondent who favors breastfeeding will choose the option of 'does not agree at all', because in line with his or her attitude, breast milk should not lack such an important micronutrient. If, on the other hand, we consider it as a

knowledge-testing question, the neutral answers will dominate because the respondent simply does not know how much iron is in breast milk

The same is true of question 1: not only individuals with a lower level of education will find it difficult interpreting the expression of “nutritional benefits”. As shown by the typically low CITC of these questions, this issue generates insecurity even in those respondents who strongly favor breastfeeding. This might be one reason why the simplified version of this question has been used within the Northern Ireland research, asking simply about the long-term benefits of breastfeeding (22). No matter whether we measure knowledge, attitude, or belief with these two questions, they do not align with the other items on the scale. Therefore, items 1 and 4 were also left out when we were looking for briefer options to make the scale easy to use in other research because of its brevity, clarity, and more accurate measurement results.

Questions 8 (in public places) and 17 (alcohol) are strongly related to social environments and their norms, as revealed by a survey of several national versions of IIFAS (12, 21, 28, 29). In the case of question 17, the answer is not primarily determined by the level of knowledge about breastfeeding, nor by the attitude of breastfeeding, but rather by the social acceptance of alcohol consumption, including maternal alcohol consumption. That is, this question in its present form is most likely not suitable for measuring attitudes toward infant feeding.

Item 8 examines attitudes toward breastfeeding in public venues. The results of our survey reveal that the vast majority of respondents, essentially irrespective of the feeding method used, do not agree that mothers should not breastfeed in public places. Slightly more than 80% of respondents support public breastfeeding, besides only 7.8% of the them clearly dissenting and 11.9% of them occupying a neutral position. However, the recognition of the right to breastfeed in public does not mean that this option is fully accepted or desired by the respondent, as well. Wallis's research in Romania (18) - that also asked pregnant women and postpartum mothers - revealed that the consideration of the issue is different for a respondent without a child or when the child is being expected, from the one when the baby is already born and the acceptance of public breastfeeding also provides more external room for the mother to move around with her infant. In the first 11-item version of the acronym IIFAS-H, the CITC of item 8 was just slightly below the limit. This location can be explained by the fact that personal experiences and previous experiences count equally besides attitudes when judging the issue. Therefore, this question, in addition to asking a very important point, is less suitable for measuring infant feeding attitudes and predicting behavior in this form, similar to Alkusayer's finding (27). Therefore, we left this item out of the short Hungarian version, as well.

In the case of questions 12 (*ideal food*) and 16 (*less expensive*) the CITC is likely to be low for different reasons than the ones already mentioned above. This is because these two items contain generally accepted statements that few respondents have any objections with and even the majority of respondents in favor of formula nutrition agree with their content. Therefore, these questions are less suitable for differentiating between the two extreme infant feeding behaviors compared to other items.

For question 11, the distribution of responses in our sample resulted in an extremely low CITC. The desire for fathers to strive for equal participation in upbringing and care assures this item *raison d'être*, as fathers are traditionally excluded from breastfeeding an infant. In Western countries due to the trends of globalization there is a growing expectation for fathers to get involved in the personal care of the baby, also in terms of infant feeding. However, based on the data from our respondents, we can state that the vast majority, that is, 71.5% of the respondents deny that fathers miss out on childcare because of breastfeeding. In our sample, this percentage corresponds approximately to the proportion of breastfeeding mothers exclusively for six months. In Hungary the development of gender roles within the family (30) follows a traditional pattern; however, maternity leave can be considered long compared to worldwide trends (24 weeks). In addition, the authorized maximum period of time spent at home with the child is two years which is funded by 70% of the parent's salary. Childcare is considered by society to be primarily a duty of the mother. This explains why a low CITC in our study indicates that the majority of respondents reject the idea of fathers should feel obliged to get involved in infant feeding, as well.

Conclusion

It was necessary to examine particularly the psychometric characteristics of IIFAS-H in order to develop a tool for measuring attitudes towards infant feeding that could be applied in other research, as well. In addition to the original 17-item version, the 11-item and 9-item versions also proved to be reliable. Compared to the international abbreviated IIFAS versions, we found 8 items that are both common in each version, and at the same time are part of our Hungarian 9- and 11-item scales, too. The Cronbach's alpha calculated for these 8 items also confirmed their high internal consistency. In summary, the reliability of each of the abbreviated scale versions is better than the original version consisting of 17-items. The reliability of the 8-point scale (IIFAS-H8) is only slightly lower than that of the 9-item scale (Cronbach's alpha = 0.763 vs 0.787). When adapting any scale, the best possible comparability of the international results is high priority, therefore, we recommend the use of the 8-point scale in the future.

Limitations

Our data were collected with online survey. The use of social media and virtual communities to distribute invitations to our survey can lead to sample bias. We cannot access any response rate, because we do not know, how many people have seen our announcement to the survey. In our sample, mothers with degrees of higher education and longer overall breastfeeding durations are overrepresented. Due to anonymity, survey fraud cannot be ruled out. The survey was conducted on a convenience sample of volunteers. Breastfeeding data were collected respectively and self-reported, so they are probably less accurate.

Abbreviations

IIFAS: Iowa infant feeding attitude scale

CITC: corrected item total correlation

SES: socioeconomic status

NICU: Neonatal intensive care unit

BF: breastfeeding

FF: formula feeding

F: formula

Declarations

This study was approved by the Semmelweis University Regional and Institutional Committee of Science and Research Ethics under the number of SE RKEB 79/2019.

Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interest

The authors declare that they have no competing interests.

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Authors contributions

RU and SzT were major contributors in the design of the study. RU and VB were the translators of the questionnaire. AI analysed and interpreted the data. RU and AI were major contributors of writing the manuscript. Szt and VB contributed to the final version of the manuscript. All authors read and approved the final manuscript.

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Figures

Figure 1

Scree plot of the principal component analysis of the 17 items of the Hungarian version of IIFAS (n=553).

Figure 1

Scree plot of the principal component analysis of the 17 items of the Hungarian version of IIFAS (n=553).