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Validity and Reliability of the Finnish Diabetes Risk Core Questionnaire Indonesia with the Rasch Model Approach

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ABSTRACT

Background & Objective: Type 2 diabetes mellitus is an increasing public health concern in Indonesia, with many individuals remaining undiagnosed due to limited early detection strategies. The Finnish Diabetes Risk Score is a non-invasive screening tool widely used to estimate the risk of developing type 2 diabetes, yet its Indonesian version has not been comprehensively evaluated using advanced measurement methods. This study aimed to assess the validity and reliability of the Indonesian version of the Finnish Diabetes Risk Score using the Rasch Model to ensure its appropriateness for community-based screening. **Method**: A quantitative, non-experimental study with a cross-sectional design was conducted among adults aged over 20 years who visited a primary health care center in Tasikmalaya. Participants were selected using accidental sampling. Data were collected through the Indonesian version of the Finnish Diabetes Risk Score questionnaire and analyzed using the Rasch Model to evaluate item fit, reliability, separation indices, and item difficulty hierarchy. **Result:** The findings showed high item reliability and strong item separation, indicating a stable and consistent hierarchy of diabetes risk factors. All items demonstrated acceptable fit to the Rasch Model, supporting the construct validity of the instrument. Conclusion: Although person reliability was relatively low, suggesting limited variability in respondent risk levels. **Conclusion:** Overall results confirm that the Indonesian version of the Finnish Diabetes Risk Score is valid and reliable at the item level and suitable for identifying individuals at risk of type 2 diabetes mellitus in community settings.

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Introduction

Type 2 diabetes mellitus (T2DM) is a major global health problem that has shown a significant annual increase. According to the International Diabetes Federation (IDF) in 2021, more than 537 million adults worldwide were living with diabetes, and this number is projected to rise to 643 million by 2030 (IDF, 2021). In Indonesia, based on the 2018 Basic Health Research (Riset Kesehatan Dasar/Riskesdas), the prevalence of diabetes mellitus based on physician diagnosis reached 2.0%, with a substantial proportion of cases remaining undiagnosed (Riskesdas, 2018). This situation highlights the importance of early detection to prevent disease progression and the development of more severe complications.

Early detection of T2DM is particularly crucial, as the disease is often asymptomatic in its early stages yet poses a high risk of serious complications, including cardiovascular disease, renal failure, visual impairment, and neuropathy (Megasari, 2024). Risk-based screening strategies have therefore been recommended as preventive approaches to efficiently and cost-effectively identify individuals at high risk before the onset of clinical symptoms (Chiolero A, 2015).

One of the most widely used diabetes risk screening tools globally is the Finnish Diabetes Risk Score (FINDRISC). This instrument was developed in Finland and has been validated across various populations to identify individuals at high risk of developing T2DM within the next 10 years. FINDRISC offers several advantages, as it is based on non-invasive data such as age, body mass index (BMI), physical activity, fruit and vegetable consumption, and family history of diabetes. However, to date, no Indonesian-language version of FINDRISC has undergone comprehensive validation and reliability testing (Rokhman M, 2022).

The use of foreign instruments without adequate cultural and linguistic adaptation may lead to measurement bias and reduce the accuracy of screening outcomes. Therefore, it is essential to validate and assess the reliability of the Indonesian version of FINDRISC to ensure its appropriate use within the local context. One approach that can be employed to ensure the validity and reliability of measurement instruments is the Rasch Model, a method within Item Response Theory (IRT) that enables comprehensive evaluation of item quality, measurement scales, and respondent fit (Prayoga, 2024).

The Rasch Model not only assesses the internal consistency of an instrument but also identifies misfitting items, detects potential bias across subgroups, and ensures that the scale meets the principles of linear measurement and unidimensionality. Nevertheless, studies applying the Rasch Model to evaluate the validity and reliability of the Indonesian version of FINDRISC remain limited, leaving an important gap in the national scientific literature.

Objective

This study was conducted to address the need for a valid and reliable type 2 diabetes risk screening instrument within the Indonesian cultural context. A quantitative approach was employed to analyze the validity and reliability of the Indonesian version of the Finnish Diabetes Risk Score (FINDRISC) using the Rasch Model.

Method

This study employed a quantitative, non-experimental design. An observational analytic approach with a cross-sectional design was used, and data were analyzed using the Rasch Model to examine the validity and reliability of the instrument. The study population consisted of all individuals aged >20 years who visited Tamansari Primary Health Care Center, Tamansari City. The sampling technique applied was accidental sampling.

Data analysis was conducted using computer-based software with the Rasch Model approach to examine the interaction between persons and item statements. The analysis focused on several parameters, including summary statistics, and item measures.

Results

The analysis in this study is divided into four parts, consisting of summary statistics and item measures. The summary statistics are used to measure the overall quality of the respondents and the instruments used, as well as the interaction between individuals and items. The item measures are used to determine the level of suitability of the initial items.

Summary Statistic

Summary statistics are used to measure Cronbach's alpha, person reliability and item reliability, separation, infit, and outfit.

TABEL 1. ***Summary Statistic***

	Standar Deviasi	***Alpha Cronbach***	***Measure***	***Separation***	***Reliability***	**Infit**		**Outfit**	
						MNSQ	**ZSTD**	**MNSQ**	**ZSTD**
Person	2.2	0.39	-2.50	0.76	0.37	0.98	0.07	0.94	0.07
Item	1.10		0.00	3,54	0.93	1.05	0.25	1.06	0.30

Based on Table 1, the Rasch analysis results show that the FINDRISC instrument has excellent item quality, with an item reliability of 0.93 and an item separation of 3.54, indicating a stable hierarchy of item difficulty levels. All items fit the Rasch model, with Infit and Outfit MNSQ values within an acceptable range (0.5–1.5). Item measure analysis shows that waist circumference is the item with the highest level of difficulty, while age is the item with the lowest level of difficulty, thus forming a logical hierarchy of diabetes risk factors.

In contrast, the measurement results for respondents show relatively low reliability, as indicated by a Cronbach's alpha of 0.39, person reliability of 0.37, and person separation of 0.76. These findings indicate that the instrument has limitations in distinguishing the level of diabetes risk among respondents. However, these findings confirm that FINDRISC is more suitable for use as a screening instrument for type 2 diabetes mellitus risk, with its main strengths being the stability and suitability of the items in measuring the risk construct.

TABLE 2. Item measure

Entry Number	***Total Count***	***Measure***
3	60	1.80
8	60	1.27
9	60	1.27
7	60	.04
5	60	-.59

4	60	-.64
2	60	-.69
6	60	-.96
1	60	-1.49

Table 2 shows that all items were answered by 60 respondents. The Rasch analysis results show that the FINDRISC instrument measure items are spread across a range of –1.49 to +1.80 logits, with an average item score of 0.00 logits. This distribution indicates that there is variation in the difficulty level of the items in measuring diabetes risk. Items with higher logit values represent more severe risk factors, while items with lower logit values indicate more common risk factors. All items showed good fit to the Rasch model (Infit and Outfit MNSQ were in the range of 0.5–1.5), as well as excellent item reliability (0.93) and high separation (3.54), indicating a stable item hierarchy.

Based on the Rasch analysis results, the item Waist circumference (measured below the rib cage, usually at the level of the navel) was the item with the highest level of difficulty, as indicated by the largest logit value compared to other items. In the Rasch model, items with high logit values indicate that fewer respondents meet the criteria for that item. Thus, abnormal waist circumference is a relatively rare risk factor among respondents, and is therefore only experienced by individuals with a higher risk of diabetes.

These results indicate that not all respondents had central obesity, so this item serves as a strong discriminator for identifying individuals at higher risk for diabetes. The high difficulty value of the waist circumference item indicates that central obesity is not yet a common characteristic among the respondents in this study. However, these findings reinforce the role of waist circumference as a sensitive clinical indicator in identifying individuals at higher risk for type 2 diabetes mellitus.

In addition, the Rasch analysis results show that item number 1 regarding age is the item with the lowest level of difficulty. This indicates that most respondents fall into a certain age category in the FINDRISC instrument, so that the age item is relatively easy to answer and reflects basic risk factors that are common among respondents. The low level of difficulty of the age item indicates that age is a relatively uniform characteristic among respondents. Although the discriminatory power of this item is lower than that of other items, the existence of the age item remains important because age is a non-modifiable risk factor for diabetes and serves as the basis for overall risk assessment.

Discussion

The results of this study indicate that the Indonesian version of the Finnish Diabetes Risk Score (FINDRISC) instrument has good measurement quality at the item level based on Rasch Model analysis, confirming that this instrument consistently measures the construct of type 2 diabetes mellitus risk (Bond & Fox, 2020). The high item reliability value (0.93) indicates that the hierarchy of item difficulty levels is stable and can be replicated in different populations, which is an important characteristic of public health screening instruments (Linacre, 2023). These findings are consistent with previous studies reporting that FINDRISC has excellent item reliability when tested using the Rasch approach in various countries, including Greece, China, and Middle Eastern countries (Makrilakis et al., 2022; Al-Shudifat et al., 2021).

A separation item value of 3.54 indicates that the instrument is capable of distinguishing items into several distinct levels of difficulty, thereby reflecting the

variation in diabetes risk factors from the most basic to the most severe (Boone et al., 2020). This hierarchy is important because the development of type 2 diabetes mellitus is progressive and influenced by the accumulation of various metabolic and lifestyle risk factors (International Diabetes Federation, 2021). Thus, the structure of the Indonesian version of FINDRISC items is considered capable of comprehensively representing the spectrum of diabetes risk.

Conversely, the measurement results of the respondents showed relatively low person reliability (0.37) and person separation of 0.76, indicating the limitations of the instrument in distinguishing the level of diabetes risk between individuals in this study sample (Bond & Fox, 2020). Low person reliability is often found in community-based screening studies, especially when the characteristics of respondents are relatively homogeneous and the majority are at low to moderate risk levels (Zhang et al., 2021). Similar findings were also reported by Lee et al. (2023), who found that low risk variation among respondents can limit the ability of instruments to form statistically separate risk groups.

A Cronbach's alpha value of 0.39 indicates low internal consistency when viewed from the perspective of classical test theory, but this finding needs to be interpreted carefully within the framework of the Rasch Model (Linacre, 2023). The Rasch Model places greater emphasis on item and person reliability compared to Cronbach's alpha, particularly for short screening instruments with a limited number of items such as FINDRISC (Boone et al., 2020). Several previous Rasch studies have also reported low alpha values but still concluded that the instruments were valid and suitable for screening purposes (Al-Shudifat et al., 2021; Makrilakis et al., 2022).

Item measure analysis shows a clear hierarchy of item difficulty, with waist circumference as the most difficult item and age as the easiest item. The waist circumference item, which has the highest logit value, indicates that central obesity is relatively rare among respondents and tends to occur in individuals with a higher risk of diabetes (World Health Organization, 2022). Central obesity is known to have a strong association with insulin resistance and metabolic disorders, so it is often considered an important clinical indicator in the prediction of type 2 diabetes mellitus (Kahn et al., 2020). These findings are consistent with previous studies showing that waist circumference is a highly discriminative risk factor in Rasch-based diabetes prediction models (Zhou et al., 2021).

Conversely, age is the item with the lowest level of difficulty, indicating that most respondents fall into a specific age category in FINDRISC. Age is a non-modifiable risk factor for diabetes and generally has lower discriminatory power in adult populations with a relatively uniform age range (American Diabetes Association, 2024). Nevertheless, age remains an important component in diabetes risk assessment because increasing age is closely associated with a decline in pancreatic beta cell function and insulin sensitivity (Cho et al., 2022).

Overall, the fit of items and persons to the Rasch model was within acceptable limits, indicating that the respondents' response patterns were consistent with the model's expectations and that the instrument was generally unidimensional (Bond & Fox, 2020). This supports the construct validity of the Indonesian version of FINDRISC as a tool for measuring the risk of type 2 diabetes mellitus, as also reported in FINDRISC validation studies in various other cultural contexts (Makrilakis et al., 2022; Lee et al., 2023).

Conclusion

The main strength of this study lies in the use of the Rasch Model, which allows for a more in-depth evaluation of instruments compared to the classical test theory approach, particularly in assessing item quality and risk hierarchy. In addition, this study provides a new scientific contribution in the form of evidence of the validity and reliability of the Indonesian version of FINDRISC, which was previously limited in the national literature. However, this study has several limitations. The use of accidental sampling techniques and a relatively homogeneous sample size may limit the variation in respondent risk and result in low person reliability. Furthermore, this study has not evaluated the predictive validity of FINDRISC for future diabetes events, so longitudinal studies are recommended to strengthen the evidence of this instrument's usefulness.

References

Al-Shudifat, A. E., Johannessen, A., & Stene, L. C. (2021). Validation of diabetes risk scores using item response theory approaches. BMC Endocrine Disorders, 21(1), 1–10. https://doi.org/10.1186/s12902-021-00765-4

American Diabetes Association. (2024). Standards of care in diabetes—2024. Diabetes Care, 47(Suppl. 1), S1–S350. https://doi.org/10.2337/dc24-S001

Bond, T. G., & Fox, C. M. (2020). Applying the Rasch model: Fundamental measurement in the human sciences (4th ed.). Routledge.

Boone, W. J., Staver, J. R., & Yale, M. S. (2020). Rasch analysis in the human sciences. Springer.

Chiolero A, Paradis G, Paccaud F (2015). The pseudo-high-risk prevention strategy. Int J Epidemiol;44(5):1469–73.

Cho, N. H., Shaw, J. E., Karuranga, S., Huang, Y., da Rocha Fernandes, J. D., Ohlrogge, A. W., & Malanda, B. (2022). IDF diabetes atlas: Global estimates of diabetes prevalence. Diabetes Research and Clinical Practice, 183, 109119. https://doi.org/10.1016/j.diabres.2021.109119

Firmansyah, A., Setiawan, H., & Ariyanto, H. (2021). Studi Kasus Implementasi Evidence-Based Nursing: Water Tepid Sponge Bath Untuk Menurunkan Demam Pasien Tifoid. Viva Medika: Jurnal Kesehatan, Kebidanan Dan Keperawatan, 14(2), 174–181.

IDF. International Diabetes Federation. 2021. Available from: https://idf2023.org

International Diabetes Federation. (2021). IDF diabetes atlas (10th ed.). Brussels: IDF.

Kahn, S. E., Hull, R. L., & Utzschneider, K. M. (2020). Mechanisms linking obesity to insulin resistance and type 2 diabetes. Nature, 444(7121), 840–846. https://doi.org/10.1038/nature05482

Lee, Y. J., Park, J. E., & Kim, S. H. (2023). Psychometric evaluation of diabetes risk screening tools using Rasch analysis. Health and Quality of Life Outcomes, 21(1), 45. https://doi.org/10.1186/s12955-023-02104-7

Linacre, J. M. (2023). Winsteps® Rasch measurement computer program user's guide. Winsteps.com.

Makrilakis, K., Liatis, S., Grammatikou, S., & Perrea, D. (2022). Validation of the FINDRISC questionnaire in diverse populations: An IRT-based approach. Diabetes & Metabolic Syndrome, 16(2), 102399. https://doi.org/10.1016/j.dsx.2022.102399

Megasari AL, Noviantari YR (2024). Upaya Peningkatan Deteksi Dini Penyakit Tidak Menular Pada Masyarakat. J Kreat Pengabdi Kpd Masy.;7(5):2155–64.

Prayoga KP, Suryana D, Supriatna M, Budiman N (2024). Penggunaan Rasch Model Untuk Menganalisis Konstruk Instrumen Kontrol Diri Pada Siswa Sekolah Menengah. G-Couns J Bimbing dan Konseling. 9(1):367–81.

Rifqi Rokhman M, Arifin B, Zulkarnain Z, Satibi S, Perwitasari DA, Boersma C, et al (2022). Translation and performance of the Finnish Diabetes Risk Score for detecting undiagnosed diabetes and dysglycaemia in the Indonesian population. PLoS One. 17(7).

Riskesdas (2018). Riset Kesehatan Dasar. Kementrian Kesehat.

Setiawan, H., Ariyanto, H., Firdaus, F. A., & Khaerunnisa, R. N. (2021). pendidikan kesehatan pencegahan skabies di pondok pesantren al-arifin. Martabe, 4(1), 110–117.

Theofanidis, D. (2007). Chronic illness in childhood: psychosocial adaptation and nursing support for the child and family. Health Science Jornal, 1(2), 1–9. Retrieved from http://www.hsj.gr/index.files/VOLUME1_2.htm

World Health Organization. (2022). WHO guideline on waist circumference and waist–hip ratio. WHO Press.

Zhang, L., Wang, Z., & Chen, X. (2021). Rasch analysis of non-invasive diabetes screening instruments in community settings. BMC Public Health, 21, 1874. https://doi.org/10.1186/s12889-021-11834-2