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Translation, adaptation, and validation of Indonesian version of Prenatal Health Behavior Scale

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ABSTRACT

Objective: To translate, adapt, and validate the Indonesian version of the Prenatal Health Behavior Scale.**Methods:** This cross-sectional, cross-cultural adaptation study was conducted between September 2024 and October 2024 in Ngrambe and Sine, subdistricts in Ngawi, East Java, Indonesia. We selected participants using purposive convenience sampling and matched them with inclusion and exclusion criteria. We collected sociodemographic, Prenatal Health Behavior Scale, and anthropometrics (height, weight, body mass index, and middle-upper arm circumference) data. We analyzed the content validity using the content validity index and Gwet's chance-corrected Agreement Coefficient 2, face validity by pilot-testing on several pregnant women, and construct validity using exploratory factor analysis. We measured reliability using McDonald's omega coefficient.**Results:** We recruited 183 pregnant women in this study (median age 28 years). The item-content validity index (I-CVI) of all items was 1.00, with Gwet's chance-corrected Agreement Coefficient 2 was 0.945. The face validity resulted in a clear statement of all items. The exploratory factor analysis showed the two-factor model best suited to the questionnaire. Omega coefficients for the overall scale, health-impairing, and health-promoting domains were 0.696, 0.507, and 0.678, respectively.**Conclusions:** The Indonesian version of the Prenatal Health Behavior Scale is a valid and reliable instrument to assess prenatal health behavior in Indonesian-speaking pregnant women. Future studies may implement this scale in community and clinical settings.**KEYWORDS:** Prenatal; Health behavior; Scale; Validation study

1. Introduction

Prenatal behaviors have a significant impact on the success of pregnancy. The World Health Organization (WHO) recommends that pregnant women seek pre-pregnancy counseling on healthy behaviors, including a nutritious diet, exercising, taking daily supplements, and avoiding substance use and abuse[1]. These

Key Points

Question: What is the validity and reliability of the Indonesian version of the Prenatal Health Behavior Scale (PHBS)?**Findings:** In this psychometric properties study of the Indonesian version of the PHBS, the adapted scale has good content with a high agreement coefficient and construct validity and good reliability for both health-promoting and health-impairing behavior factor.**Meaning:** The validated Indonesian version of PHBS can be used to assess the health behavior of pregnant mothers in Indonesia.✉To whom correspondence may be addressed. E-mail: riskifarandi@gmail.com

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behaviors influence the pregnancy outcome, both for the mother and child. Poor or health-impairing prenatal behavior increases the likelihood of several poor pregnancy outcomes, including insufficient gestational weight gain, preterm delivery, long-term comorbidity of the mother and child, and mortality[2]. On the contrary, health-promoting prenatal behavior is associated with superior pregnancy outcomes, including reducing the risk of developing preeclampsia and gestational hypertension, reducing stress, and improving the long-term health of the mother and child[3].

Several instruments or questionnaires have been developed to assess these behaviors, including the food frequency questionnaire (FFQ), Healthy Lifestyle Behavior Scale (HLBES), Health Practice Questionnaire in Pregnancy (HPQ), and Prenatal Health Behavior Scale (PHBS). These reliable instruments have been widely used and validated with several differences. FFQ mainly focuses on the dietary profile of pregnant women in a quantitative or semi-quantitative manner. This instrument may also be specific to each population, as people from different locations may have different dietary patterns[4,5]. HLBES, developed by Melnyk in 2003, assesses three domains: dietary, physical activity, and mental health[6]. Another instrument created by Tiedje *et al* in 1992 and then modified by Lindgren in 2005 consists of six domains: balancing exercise and rest, taking safety measures during pregnancy, maintaining recommended nutritional intake, avoiding the use of harmful substances, obtaining adequate health care for herself, and activity to obtain information regarding pregnancy and childbirth[7]. Lobel *et al* also developed another instrument, PHBS, which measures two domains: health-impairing behavior (including using harmful substances, eating oily foods, and bending the body) and health-promoting behavior (including eating fruit or vegetables, exercising, and taking vitamins)[8].

While these instruments differ, assessing these behaviors leads to optimal screening and targeted intervention, which benefits pregnant women. A large randomized controlled trial in nutrition and health behavior change communication shows a lower prevalence and lower risk of undernutrition when compared to the control group[9]. Other trials focusing on mental health also show a reduction in anxiety and psychosocial stress and an improved prenatal attachment when compared to controls[10]. Another randomized controlled trial of pelvic floor muscle exercise has shown significant differences in quality of life between the groups post-intervention[11]. These studies imply that targeted intervention may complement screening-based programs, with at-risk pregnant women being followed up and monitored periodically.

Based on our knowledge, no structured instrument assesses prenatal health behavior in an Indonesian setting. Considering the impact of a holistic assessment of these behaviors, specifically the health-impairing activity, adds the need for an instrument to facilitate health practitioners to be involved in screening and further intervention

based on the assessment result. This study aims to translate, adapt, and validate the Indonesian version of PHBS, one of the widely used instruments to assess prenatal health behavior. This adapted scale may be used to screen at-risk pregnant women and as a base for specific interventions to address the significant issues.

2. Methods

2.1. Study design

This study uses a cross-sectional design to translate, adapt, and validate the Prenatal Health Behavior Scale. We conducted the study in September-October 2024 in two Ngawi subdistricts, Ngrambe and Sine, subdistricts located in the west of Ngawi, at the heel of the north of Mount Lawu. Ngawi is one of the most western regencies in East Java, Indonesia, and these two subdistricts are the most western in Ngawi.

2.2. Participants

All pregnant mothers were included in the inclusion criteria. The exclusion criteria were those who do not fill out the questionnaire fully, need assistance to read it, and pregnant mothers with infectious comorbidity, *e.g.*, pulmonary tuberculosis, hepatitis, and syphilis, as it may influence the anthropometric measurement. We used primary data from a printed questionnaire distributed to pregnant mothers. We adapt the processes from Tsang *et al* and Epstein *et al*, which consist of asking permission, translating (forward and backward), and testing the validity and reliability of the Indonesian version of the PHBS[12,13]. The study consists of two significant processes: the first is to create the final Indonesian version of the PHBS, and the second is to analyze which factor is associated with chronic energy deficiency. The second part of this study will be published separately. The flowchart of this study is presented in Figure 1.

2.3. Data collection procedures

We collected sociodemographic, the final Indonesian version of PHBS, and anthropometrics data from any pregnant mother from the first to third trimester of pregnancy who came for medical examination in Ngrambe and Sine Community Health Center or Community Health Effort in the scope of mother's health, a program planned to enhance pregnant mothers' knowledge, attitude, and practice toward perinatal health and the importance of the 1 000 first days of life. Every participant will first fill out the questionnaire, followed by anthropometric measurements.

We collected several sociodemographic data, including age, income, education, occupation, marriage status, and obstetric history.

PHBS is an instrument developed by Lobel *et al* to measure

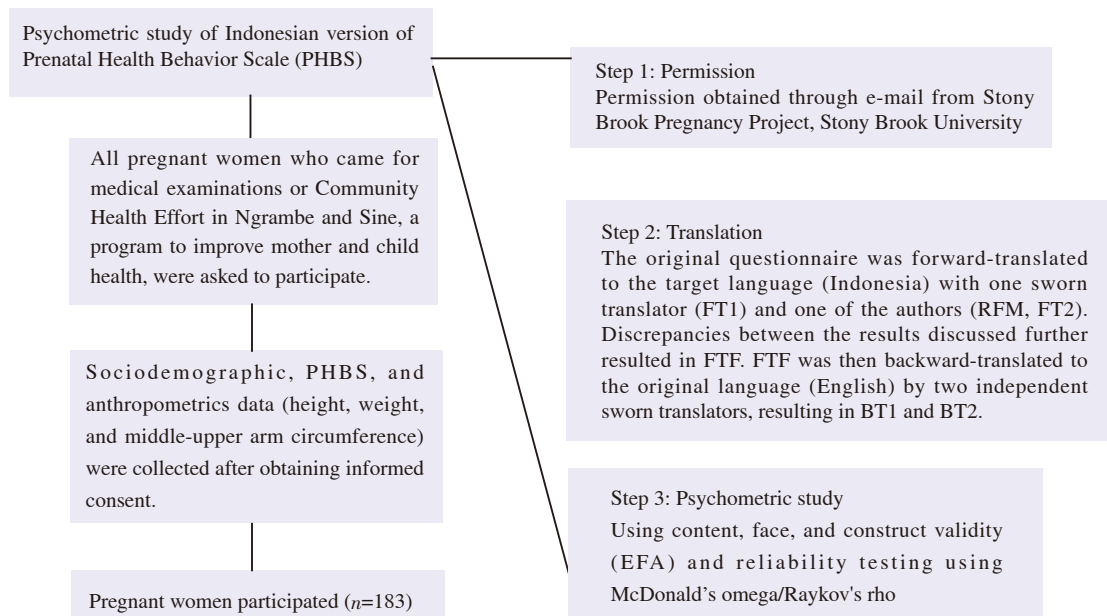


Figure 1. Flowchart of the study. FT: forward translation; FTF: forward translation-final; BT: backward translation; EFA: exploratory factor analysis.

prenatal health behavior using a 5-point Likert scale from "never" to "almost always" two weeks before[8]. The 24 items are divided into two subscales: "health-impairing," which consists of items like smoking, skipping a meal, standing for a longer duration, and "health-promoting" behavior, which includes items like exercising at least 15 minutes, getting enough sleep, and getting enough hydration. Previous studies have shown Cronbach's alpha for reliability of health-promoting and health-impairing subscales varied from 0.71-0.76 and 0.55-0.70, respectively[14-16].

As for anthropometrics data, we measured the mother's height, weight, and middle-upper arm circumference (MUAC).

A detailed explanation of the data collection, including anthropometric measurement, will be published separately.

Several studies have shown that the number of participants per item, 5:1 to 10:1, was considered optimal for the minimum sample size to include in psychometric properties[17-19]. Because PHBS has 24 items, the sample's minimum number was 120 participants. We used purposive convenience sampling to gather the data.

2.4. Instrument adaptation

The steps of the psychometric analysis are explained below:

(1) Step 1: Permission.

We obtained permission to adapt PHBS through e-mail to the Stony Brook Pregnancy Project, Department of Psychology, Stony Brook University.

(2) Step 2: Translation.

First, we applied a forward translation of the original PHBS to Indonesian, involving two independent translators whose primary

spoken language is Indonesian. One of them was a sworn translator and came from a non-health background. The other is one of the authors (RFM). The results were marked as FT1 and FT2. Any discrepancies between the translations discussed by the translators resulted in FTF as the final forward translation result.

Then, the FTF is backward translated to the original language (English) by two independent sworn translators whose primary spoken language is English. These two came from a non-health background. The results were marked as BT1 and BT2.

We then invited all translators to discuss discrepancies further through an online meeting. No further adjustments were made to FTF.

The result of the translation is presented in Table 1.

(3) Step 3: Psychometric testing.

We applied content, face, and construct validity to measure the psychometric properties of the translated PHBS.

We used the approach described by Yusoff *et al* and Roebianto *et al* for content validity measurement[20,21]. We invited six independent experts from various professions, including midwifery, nursing, general physician, psychiatrist, and obstetrician, with experience in women's health. Several of them had never had experience reviewing questionnaires. Thus, the author provided a detailed explanation to help them measure each item's relevancy and clarity using a four-point Likert scale. After we acquired the results, we invited them to discuss their discrepancies through online meetings, as offline meetings were not feasible. These resulted in the pre-finalized Indonesian version of PHBS.

This version was then pilot-tested in five pregnant women who underwent prenatal examination for face validity. Any wording

Table 1. Results of forward and backward translation compared with the original language of Prenatal Health Behavior Scale (PHBS).

Item	OQ	FT1	FT2	FTF	BT1	BT2
1	Exercise for at least 15 minutes?	Berolahraga minimal 15 menit?	Berolahraga setidaknya selama 15 menit?	Berolahraga setidaknya selama 15 menit?	Exercise for at least 15 minutes?	Exercising for at least 15 minutes?
	What exercise did you do?	Apa olahraga yang Anda lakukan?	Olahraga apa yang Anda lakukan?	Olahraga apa yang Anda lakukan?	What type of exercise did you do?	What exercise did you do?
2	Get enough sleep?	Tidur cukup?	Mendapatkan cukup tidur?	Mendapatkan cukup tidur?	Get enough sleep?	Getting enough sleep?
3	Drink milk, eat dairy products (such as yogurt or cheese), or take a calcium supplement?	Mengonsumsi susu, olahan susu (seperti yogurt atau keju), atau suplemen kalsium?	Minum susu, makan produk susu (seperti yogurt atau keju), atau mengonsumsi suplemen kalsium?	Minum susu, makan produk susu (seperti yogurt atau keju), atau mengonsumsi suplemen kalsium?	Drink milk, eat dairy products (such as yogurt or cheese), or take calcium supplement?	Drinking milk, eat dairy products (such as yogurt or cheese), or take calcium supplement?
4	Eat fatty or oily foods?	Mengonsumsi makanan berlemak atau berminyak?	Makan makanan berlemak atau berminyak?	Makan makanan berlemak atau berminyak?	Eat fatty or oily foods?	Eating fatty or greasy foods?
5	Smoke cigarettes?	Merokok?	Merokok?	Merokok?	Smoke?	Smoking?
6	Take vitamins?	Mengonsumsi vitamin?	Mengonsumsi vitamin?	Mengonsumsi vitamin?	Take vitamins?	Taking vitamins?
7	Eat snack foods instead of regular meal?	Mengonsumsi makanan ringan dibandingkan makanan porsi?	Makan makanan ringan daripada makanan reguler?	Makan makanan ringan dibandingkan makanan porsi?	Eat snacks instead of full meals?	Eating light meals rather than portioned meals?
8	Stand on your feet for long periods of time?	Berdiri dalam waktu yang cukup lama?	Berdiri di kaki Anda untuk jangka waktu yang lama?	Berdiri di kaki Anda untuk jangka waktu yang lama?	Stand on your feet for long periods?	Standing on your feet for long periods of time?
9	Drink thing with caffeine such as coffee or colas?	Mengonsumsi minuman yang mengandung kafein seperti kopi atau soda?	Minum minuman yang mengandung kafein seperti kopi atau kola?	Minum minuman yang mengandung kafein seperti kopi atau kola?	Drink beverages containing caffeine such as coffee or cola?	Drinking beverages that contain caffeine such as coffee or cola?
10	Eat enough food to satisfy your hunger?	Makan yang cukup untuk mengatasi rasa lapar?	Makan cukup makanan untuk memuaskan rasa laparmu?	Makan yang cukup untuk memuaskan rasa laparmu?	Eat enough to satisfy your hunger?	Eating enough to satisfy your hunger?
11	Stretch your muscles or do calisthenics?	Melakukan peregangan otot atau senam?	Meregangkan otot-otot Anda atau melakukan gerakan kalistenik?	Meregangkan otot-otot Anda atau melakukan senam?	Stretch your muscles or do exercises?	Stretching your muscles or doing gymnastics?
12	Eat high-fiber foods such as whole grain breads or cereals?	Mengonsumsi makanan tinggi serat seperti roti gandum utuh atau sereal?	Makan makanan tinggi serat seperti roti gandum utuh atau sereal?	Makan makanan tinggi serat seperti roti gandum utuh atau sereal	Eat high-fiber foods such as whole grain bread or cereal?	Eating foods high in fiber like whole wheat bread or cereal?
13	Lift heavy objects or do lots of bending?	Mengangkat benda berat atau banyak membungkukkan badan?	Mengangkat benda berat atau banyak membungkuk?	Mengangkat benda berat atau banyak membungkuk?	Lift heavy objects or bend frequently?	Lifting heavy objects or bending a lot?
14	Use medicines prescribed by a doctor other than vitamins?	Mengonsumsi obat-obatan yang diresepkan dokter selain vitamin?	Menggunakan obat yang telah diresepkan oleh dokter selain vitamin?	Menggunakan obat yang diresepkan oleh dokter selain vitamin?	Use medications prescribed by a doctor other than vitamins?	Taking medication prescribed by a doctor other than vitamins?
	What did you take?	Apa obat yang Anda konsumsi?	Apa yang Anda lakukan?	Obat apa yang Anda gunakan?	What medications did you use?	What medications do you take?
15	Over-stretch or twist your body?	Terlalu meregangkan tubuh atau memutar tubuh Anda?	Meregangkan atau memutar tubuh Anda?	Terlalu meregangkan atau memutar tubuh Anda?	Overstretch or twist your body?	Overstretching or twisting your body?
16	Drink alcohol, including wine or beer or liquor?	Mengonsumsi minuman beralkohol seperti anggur atau bir?	Minum alkohol, termasuk anggur atau bir atau minuman keras?	Minum alkohol, termasuk anggur, bir, atau minuman keras?	Drink alcohol, including wine, beer, or liquor?	Drinking alcohol, including wine or beer or liquor?
17	Get some extra sleep because you felt tired?	Pergi tidur karena merasa lelah walaupun bukan jam tidur?	Tidur lebih banyak karena kamu merasa lelah?	Tidur lebih banyak karena Anda merasa lelah?	Sleep more because you felt tired?	Sleeping more because you feel tired?
18	Drink enough fluids?	Mengonsumsi cukup cairan?	Minum cukup cairan?	Minum cukup cairan?	Drink enough fluids?	Drinking enough water?

Table 1. Continued.

Item	OQ	FT1	FT2	FTF	BT1	BT2
19	Smoke pot or marijuana?	Merokok ganja atau marijuana?	Merokok ganja atau mariyuana?	Merokok ganja atau mariyuana?	Smoke marijuana?	Smoking weed or marijuana?
20	Eat more food than you needed to?	Mengonsumsi lebih banyak makan lebih dari biasanya?	Makan lebih banyak makanan dari yang Anda butuhkan?	Makan lebih banyak makanan dari yang Anda butuhkan?	Eat more food than you needed?	Eating more food than you need?
21	Skip a meal, such as breakfast or lunch?	Melewatkan makan seperti tidak sarapan atau makan malam?	Melewatkan satu waktu makan, seperti sarapan atau makan siang?	Melewatkan satu waktu makan seperti sarapan atau makan siang?	Skip a meal such as breakfast or lunch?	Skipping a meal such as breakfast or lunch?
22	Use cocaine, crack, or other hard drugs?	Mengonsumsi narkotika seperti kokain dan obat-obatan keras lainnya?	Menggunakan kokain, crack, atau obat-obatan keras lainnya?	Menggunakan kokain, heroin, atau obat-obatan keras lainnya?	Use drugs such as cocaine or heroin?	Using cocaine, heroin, or other hard drugs?
23	Eat a balanced diet, including fruits and vegetables?	Memiliki pola makan gizi seimbang termasuk buah dan sayur?	Makan makanan seimbang, termasuk buah-buahan dan sayuran?	Makan makanan gizi seimbang termasuk buah-buahan dan sayuran?	Eat a balanced diet including fruits and vegetables?	Eating balanced nutritional foods including fruit and vegetables?
24	Use store-bought medicines such as aspirin or cough syrup? What did you use?	Membeli obat bebas di apotek seperti obat pereda nyeri atau batu? Apa obat yang Anda gunakan?	Menggunakan obat-obatan yang dibeli di toko seperti aspirin atau sirup batuk? Apa yang Anda gunakan?	Menggunakan obat bebas di apotek seperti obat pereda nyeri atau batuk? Apa obat yang Anda gunakan?	Use over-the-counter medications such as pain relievers or cough medicine? What medications did you use?	Taking over-the-counter medicines at the pharmacy such as pain reliever or cough relievers? What medication did you take?

OQ: original questionnaire; FT: forward translation; FTF: forward translation-final; BT: backward translation.

adjustment was based on the qualitative feedback we obtained during cognitive interviews with the participants surrounding the clarity of each item and the questionnaire format. Their responses were not included in the construct validity and reliability analysis.

2.5. Statistical analysis

We used an automatic measurement template provided by Ibrahim *et al* for content validity assessment, which uses the item-level content validity index, Gwet's chance-corrected Agreement Coefficient 2 (AC2), and standard error (SE)[22].

We approached construct validity with exploratory factor analysis to explore the latent factor in our adapted PHBS. We calculated the Kaiser-Meyer-Olkin (KMO) Test for Sampling Adequacy and Bartlett's Test of Sphericity for exploratory factor analysis (EFA) requirements. We used Horn's parallel analysis for factor retention and continued with oblique promax rotation for factor analysis using the iterated principal factor approach. Based on the growing literature, we measured McDonald's omega/Raykov's rho for reliability[23].

We used Stata MP17 (StataCorp, College Station, Texas) for statistical analysis. A *P*-value <0.05 was considered statistically significant.

2.6. Ethics statement

Our study was conducted according to the Declaration of Helsinki.

Our study obtained ethical clearance from the Research Ethics Committee of the Faculty of Medicine, Universitas Indonesia (KET-1236/UN2.F1/ETIK/PPM.00.02/2024, issued on August 30, 2024). We obtained informed consent from each participant. All participants were informed of their right to refuse or withdraw from the study without any adverse consequences.

3. Results

3.1. Demographic characteristic

We administered the printed questionnaire to 183 participants (pregnant mothers) who agreed to participate in this study. There was no missing data. The median age of the participants was 28 years [interquartile range (IQR) 24-31 years old], with 15.30% of them pregnant under 21 or over 35 years old. Around 84.15% were unemployed, and most of the husbands worked in the informal sector, such as farming or driving. This also accounts for 75.96% of them having combined income under the regional minimum wage (around two million rupiahs). The majority passed the high school education. The median age for first marriage was 22 years old (IQR 20-24 years old), with 63.93% being multigravida, and almost half of them were in their third trimester.

3.2. Content and face validity

The result of the content validity measurement is presented in

Table 2. Content validity analysis.

Item	R1	R2	R3	R4	R5	R6	I-CVI
1	3	4	4	4	4	4	1.00
2	3	4	4	4	4	4	1.00
3	3	4	4	4	4	4	1.00
4	3	4	4	4	4	4	1.00
5	3	4	4	4	4	4	1.00
6	3	4	4	4	4	4	1.00
7	3	4	4	3	4	4	1.00
8	3	4	3	4	3	4	1.00
9	3	4	4	4	4	4	1.00
10	3	4	4	4	4	4	1.00
11	3	4	4	4	3	4	1.00
12	3	4	4	3	4	4	1.00
13	4	4	4	4	4	4	1.00
14	4	4	4	4	4	4	1.00
15	3	4	4	3	4	4	1.00
16	4	4	4	4	4	4	1.00
17	4	4	4	4	4	4	1.00
18	4	4	4	4	4	4	1.00
19	3	4	4	4	4	4	1.00
20	4	4	4	4	4	4	1.00
21	4	4	4	4	4	4	1.00
22	4	4	4	3	4	4	1.00
23	4	4	4	4	4	4	1.00
24	4	4	4	4	4	4	1.00

R: reviewer; I-CVI: item-content validity index.

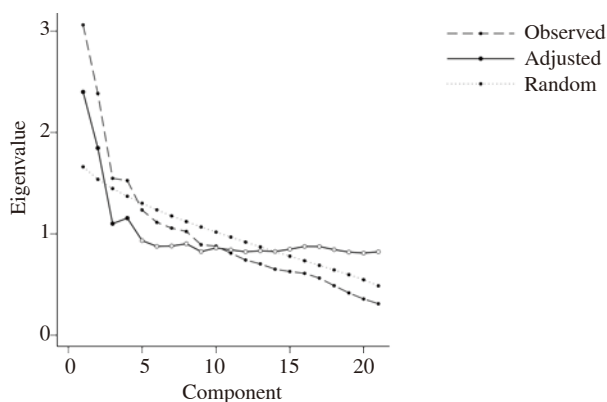
**Figure 2.** Scree plot of Horn's parallel analysis for factor retention.

Table 2. Overall, all the experts gave a satisfactory rating regarding the relevancy and clarity of each item. We found AC2 was 0.945 [confidence interval (CI) 95% 0.896-1.000, $P < 0.001$] with SE 0.037. We continued with face validity, and all the participants felt each item was apparent; hence, there was no further adjustment in the wording.

3.3. Exploratory factor analysis

Our KMO Test for Sampling Adequacy and Bartlett's Test of Sphericity results fulfilled the EFA requirements (KMO 0.650; Bartlett's Test of Sphericity $\chi^2(210) = 628.956$; $P < 0.001$). Three items (using cocaine, using weed, and using alcohol) were excluded

due to no variations in the answers. We identified four factors with adjusted eigenvalue > 1 . The scree plot is presented in Figure 2.

From the factor analysis, the unrotated matrix showed that the four factors contributed 27.8% of the variance. The rotated matrix with four factors is presented in Table 3. We used a cut-off value > 0.3 to load each item into the best-related factor; hence, we described each item in each factor: factor 1 (item 3, 6, 10, 18, 23, 24), factor 2 (item 1, 8, 11), factor 3 (item 14, 15, 17, 20, 21), and factor 4 (item 4, 7, 12). Items 2, 5, 9, and 13 were not strongly loaded onto the four-factor model. We found item 10 cross-loading between factors 1 and 4; we included it in the factor loading with the most significant factor. The omega coefficients for the overall scale and each factor from factor 1 to factor 4 were 0.650, 0.655, 0.692, 0.538, and 0.385, respectively. The overall scale and each factor have fair reliability, except for factors 3 and 4.

We also conducted factor analysis using the two-factor model as described in the original questionnaire. The rotated matrix with two factors is presented in Table 4. Using the same approach, we described each item in each factor: factor 1 (items 1, 2, 3, 6, 10, 18, 23) and factor 2 (items 8, 11, 14, 15, 21, 24). Items 4, 5, 7, 9, 12, 13, 17, and 20 were not loaded strongly to the two-factor model, and there was no cross-loading. The omega coefficients for the overall scale and each factor from factor 1 to factor 2 were 0.649, 0.678, and 0.615. We analyzed the original two-factor model, the health-impairing and health-promoting, and the omega coefficients for the overall scale. Each factor for the overall scale, health-impairing, and health-promoting factors was 0.696, 0.507, and 0.678, respectively.

Table 3. Rotated matrix of the four-factor model of the Prenatal Health Behavior Scale.

Item	Factor 1	Factor 2	Factor 3	Factor 4
1	0.176	0.715	-0.071	-0.156
2	0.223	0.051	-0.072	0.245
3	0.537	0.072	-0.007	0.016
4	-0.047	-0.128	0.232	0.396
5	-0.035	-0.138	0.067	-0.074
6	0.464	0.148	0.093	-0.038
7	0.091	-0.092	0.079	0.359
8	-0.084	0.426	0.172	0.342
9	-0.279	0.109	0.172	-0.103
10	0.397	-0.065	0.125	0.330
11	0.019	0.730	0.115	-0.080
12	-0.050	0.155	-0.278	0.568
13	-0.195	-0.083	0.270	-0.044
14	0.043	0.245	0.363	-0.017
15	-0.120	0.252	0.420	0.003
17	0.066	-0.189	0.526	0.062
18	0.619	0.031	0.148	-0.025
20	0.251	0.063	0.378	0.100
21	-0.291	0.195	0.318	0.100
23	0.524	0.186	-0.201	0.159
24	-0.312	0.185	0.144	-0.027

Table 4. Rotated matrix of two-factor model of the two-factor model of the Prenatal Health Behavior Scale.

Item	Factor 1	Factor 2
1	0.417	0.325
2	0.329	-0.023
3	0.537	-0.085
4	0.062	0.150
5	-0.139	-0.054
6	0.458	0.047
7	0.141	0.050
8	0.188	0.503
9	-0.287	0.257
10	0.405	0.022
11	0.285	0.528
12	0.244	0.030
13	-0.297	0.185
14	0.058	0.431
15	-0.096	0.525
17	-0.116	0.237
18	0.522	-0.024
20	0.201	0.279
21	-0.184	0.490
23	0.583	-0.124
24	-0.251	0.314

4. Discussion

According to our knowledge, this study is the first to translate, adapt, and validate the Indonesian PHBS and do a psychometric test of the prenatal health behavior questionnaire in Indonesia. The health behavior of pregnant women is vital to be assessed as it influences the outcome of their birth and long-term health; hence, a structured questionnaire may be used to make assessment simpler for health practitioners.

Our Indonesian version of PHBS has good content and face validity, but we had difficulties conducting the EFA. None of our community-based participants consumed substances like alcohol, cocaine, or weed. Thus, these three items were excluded from EFA. Our sample represents a more religious and conservative community. Therefore, they tend to avoid these substances, given that cocaine and weed are also illegal and not easily accessible. We also found a four-factor model compared to a two-factor model. The four-factor model may represent the nature of the item, like factor 2 consists of "mobility or exercise" behavior, and factor 1 represents "nutrition and drug" behavior, even though another drug behavior (item 14, using medicines prescribed by a doctor) is included in factor 3, which may represent the majority health-impairing behavior from the questionnaire. This finding does not suggest that the four-factor model is superior to the two-factor model, as we believe the two-factor model provides a more evident rationale for distinguishing between health-impairing and health-promoting behaviors[8]. We also found lower reliability of the health-impairing behavior factor compared to the health-promoting behavior factor, similar to previous studies. Auerbach *et al*, Pope *et al*, and Jeon

and Noh reported higher overall reliability in the two factors than our findings[14–16]. Although it highlights the lower reliability of the health-impairing behaviors, these behaviors are essential to be assessed as they influence birth outcomes, including birth weight, comorbidity, and mortality[24–27]. Our final Indonesian version of PHBS consists of the original 24 items without item reduction, as each item is relevant to pregnant women's health.

Our study has its limitations. Our study used a community-based sample and did not include troubled pregnant women who may use substances, which is seen more in clinical settings; hence, it influences our factor analysis. Our sample is homogeneous, and the behavior asked in PHBS may depict more Western behavior than that of Indonesian people. Despite surpassing the minimal sample threshold, our sample size must still be large enough to continue factor analysis using confirmatory factor analysis (CFA). However, this Indonesian version of PHBS still gives clinical meaning to assess pregnant women's behavior. It may reduce adverse birth outcomes through early detection and intervention and improve health outcomes for newborns and mothers.

Our study shows that the Indonesian version of PHBS is a valid and reliable instrument for measuring prenatal health behavior among pregnant Indonesian women. Assessing these behaviors provides valuable evidence to conduct prevention and intervention to improve pregnancy outcomes and the long-term health of women and children. Involving troubled pregnant women in a clinical setting is crucial for future studies to depict more of the health burden of pregnant women.

Conflict of interest statement

Authors declare that they have no conflicts of interest.

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Authors' contributions

Rizky F. Mubasir contributed in conceptualization, data curation, formal analysis, investigation, supervision, and visualization. Brenda A. Putri contributed in data curation, formal analysis, investigation, and writing the original draft. Valda Y. Annisa' and Dwi R. Meilina contributed in project administration, methodology, resources, and writing the original manuscript. All of the authors involved in writing, reviewing, editing, and approving the final version of the manuscript.

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