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Indonesian Version of Swedish Occupational Fatigue Inventory (SOFI): Validity and Reliability Test of Worker's Fatigue Assessment Instrument

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Abstract

Background: The Swedish Occupational Fatigue Inventory (SOFI) is an instrument to assess a person's fatigue, which is not limited to workers of a company, but can also be used for the general public. SOFI can determine fatigue from physical, cognitive and psychosocial conditions.[1] This study aims to translate the instrument so that it can be used in Indonesia, then assess its validity and reliability.
Methods: This study was conducted using a 10-step transcultural adaptation method from ISPOR followed by item validity and reliability tests on 224 workers at a geothermal company in Indonesia. Item-total correlation and Confirmatory Factor Analysis was performed using online version 0.14.3 of JASP statistic program. And for reliability test using SPSS tool.
Results: Swedish Occupational Fatigue Inventory (SOFI) has been adapted into an Indonesian version through the ISPOR transcultural adaptation method. All items in the Indonesian version of SOFI which amounted to 20 items proved the validity and reliability of this questionnaire was very good (α-Cronbach 0.969) and the Confirmatory Factor Analysis test showed: *Factor model* (224, p < 0,001) = 337.649, CFI = 0,958, NFI = 0,924, RFI = 0,909, IFI = 0,958, TLI = 0,950, dan RMSEA = 0,070, 90% CI: 0,060 – 0,081. Fit indices results had acceptable model fits corresponding to the structure of the original instrument. Item-rest correlation range from 0.321 to 0.847, these results reveal that each item-rest correlation is extremely strong.
Conclusion: The Indonesian version of SOFI is proven to have good validity and reliability as an instrument for assessing fatigue/work fatigue for workers in Indonesia.
Keyword: SOFI Indonesian Version, questionnaire, validity, reliability, fatigue, workers

Abstrak

Latar Belakang: *Swedish Occupational Fatigue Inventory (SOFI) merupakan instrument untuk menilai kelelahan pada seseorang, yang tidak terbatas pada pekerja suatu perusahaan, namun juga dapat digunakan untuk masyarakat pada umumnya. SOFI dapat mengetahui kelelahan dari kondisi fisik, kognitif serta psikososial.[1] Penelitian ini bertujuan untuk menerjemahkan instrument agar bisa digunakan di Indonesia, lalu dinilai validitas dan reliabilitasnya.*
Metode: *Penelitian ini dilakukan dengan menggunakan metode adaptasi transkultural 10 langkah dari ISPOR yang dilanjutkan dengan uji validitas dan reliabilitas item pada 224 pekerja di sebuah perusahaan panas bumi di Indonesia. Item-total correlation dan Confirmatory Factor Analysis dilakukan dengan menggunakan versi online 0.14.3 program statistik JASP. Dan uji reliabilitas dilakukan menggunakan program SPSS.*
Hasil : *Swedish Occupational Fatgue Inventory (SOFI) telah diadaptasi menjadi versi Bahasa Indonesia melalui metode adaptasi transcultural ISPOR. Seluruh item dalam (SOFI) versi Indonesia yang berjumlah 20 item terbukti validitas dan reliabilitas kuesioner ini sangat baik (α-Cronbach 0,969) dan uji Confirmatory Factor Analysis menunjukkan hasil: Factor model (224, p < 0,001) = 337.649, CFI = 0,958, NFI = 0,924, RFI = 0,909, IFI = 0,958, TLI = 0,950, dan RMSEA = 0,070, 90% CI: 0,060 – 0,081. Berdasarkan fit index, SOFI versi Bahasa Indonesia memiliki kecocokan model yang dapat diterima yang sesuai dengan struktur instrumen asli. Item-rest correlation berkisar dari 0,321 hingga 0,847, hasil ini menunjukkan bahwa setiap korelasi butir pertanyaan sangat kuat.*
Kesimpulan: *SOFI versi Bahasa Indonesia terbukti memiliki validitas dan reliabilitas yang baik sebagai instrumen penilaian fatigue/ kelelahan kerja pada pekerja di Indonesia.*
Kata kunci: *SOFI; Bahasa Indonesia; Kuesioner; Kelelahan; Pekerja*

Introduction

In the literature, the term fatigue has been widely used to indicate a clinically significant and pathological condition of fatigue.[3] It is often defined as a feeling of excessive exhaustion, tiredness, or drowsiness caused by a lack of sleep, constant mental or physical work, or prolonged stress or anxiety. Health consequences are known to be triggered by a combination of biological (circadian cycles, shift work), psychological (thoughts, emotions, and behavior), and social (social-economic, socio-environmental, and cultural factors). This can make a person feel more stressed and exhausted.[2]

Until now, there have been a variety of approaches for assessing employee weariness in both industrial and non-industrial contexts. The Fatigue Assessment Scale, the IFRC, the OFER15, and others, for example.[1] Some instruments or questionnaires can only detect weariness as a result of one of the contributing factors, such as a physical or psychosocial issue. Based on a literature study, the authors discovered another tool that can be used to detect fatigue in patients with chronic conditions (multiple sclerosis) as well as employees (drivers, resident students and others). The instrument's name is the Swedish Occupational Fatigue Inventory, which was created by Elizabeth Ahsberg.[1]

This SOFI questionnaire has 20 items that measure individual perceptions of work weariness and represent physical, cognitive, and psychosocial problems. The perceived exhaustion connected with certain duties varies depending on the demands of each individual's profession. The SOFI instrument evaluates five dimensions: condition or ability to cope with lack of energy (4 items), physical activity (4 items), discomfort with activities or physical conditions (4 items), lack of motivation (4 items), and sleepiness (e.g., a person's condition is passive, drained or saturated, or yawning) (4 items).[1]

SOFI instrument adaption, validity, and reliability research has been conducted in a number of countries; the most recent studies were conducted in Portugal (2017)[5] and Korea (2021).[4] The consistency of SOFI's questions in other nations has piqued researchers' interest in adapting this instrument for use in Indonesia, as well as testing the reliability and validity of the Indonesian version of the instrument in comparison to the original.

Methods

Research Subject

This study was carried out at a company that works in the oil and gas industry. Geothermal production is managed by this corporation in the Bandung Regency of West Java, Indonesia. After receiving research approval from the research ethics committee of the Faculty of Medicine, University of Indonesia, the director of the geothermal company in issue, and the full population of employees, the research was conducted for one week in July 2021.

The study for these findings was chosen based on predetermined inclusion and exclusion criteria. All employees who are willing to participate in/complete this questionnaire independently at the geothermal company meet the inclusion requirements. Employees who refused to participate and did not fill out the questionnaire independently in the sampling of this questionnaire could not participate (exclusion criteria) in the study because they did not finish the questionnaire and did not match the inclusion requirements. In the end, 224 people were selected as study respondents, which was accomplished by selecting all research respondents who satisfied the criteria.

Research Instrument

Primary Data

A list of questions was used to collect the primary data for this investigation. Gender, age, education, duration of work, and term of employment are among the information gathered through the questionnaire.

Statistic Analysis

The statistical analysis was performed using the online edition of the JASP tool. The internal consistency of all items in the Indonesian version of the SOFI questionnaire was then tested using the a-Cronbach reliability to determine their reliability using SPSS tool. To establish the validity of all items in the Indonesian version of the SOFI questionnaire, item-rest correlation and Confirmatory Factor Analysis were used to examine their internal validity.

Results

A demographic description is a description of a person's characteristics, such as gender, age, education, working duration, and total hours per day. This study included 224 participants, with the following demographics: There are fewer women than men in this age group, which ranges from 20 to over 50 years. And 42.9 percent of those polled have completed elementary, junior high, high school, or a similar level of education. Working duration more than 5 years (59.8%) have higher characteristics, with the majority total working 8 hours per day (63.4 percent).

The internal consistency of all items in the Indonesian version of the SOFI questionnaire was then examined using the a-Cronbach reliability method. When using SPSS to calculate the a-Cronbach coefficient, the result was 0.969. (excellent). Because the Indonesian version of the SOFI questionnaire has an internal consistency reliability of > 0.7 and consistent reliability test results for each item, it is judged thrustworthy.

Physical exertion had a 0.321 to 0.624 correlation, lack of motivation had a 0.686 to 0.844 correlation, lack of energy had a 0.817 to 0.847 correlation, physical discomfort had a 0.615 to 0.782 correlation, and sleepiness had a 0.765 to 0.835 correlation. These results

Table 1. Stage of ISPOR Transcultural Adaptation

Original Version		Stage of ISPOR Transcultural		Indonesian Version	
		1	2		
Sleepiness	Yawning	Menguap	Yawning	Perasaan Mengantuk	Menguap saat melakukan aktifitas
	Sleepy	Mengantuk	Sleepy		Mengantuk/ Letih saat melakukan aktifitas
	Falling Asleep	Tertidur	Fall asleep		Merasa akan tertidur saat melakukan aktifitas
	Drowsy	Hampir tertidur	Drowse		Merasa aktifitas pekerjaan membuat mengantuk
Physical Discomfort	Tense Muscle	Otot yang tegang	Tense Muscle	Ketidaknyamanan Fisik	Otot merasa tegang
	Aching	Rasa sakit	Aching		Rasa Nyeri pada bagian tubuh
	Stiff Joint	Sendi kaku	Stiff Joint		Sendi mengalami rasa kaku
	Numbness	Mati rasa	Numbness		Rasa Mati Rasa/ Baal pada bagian tubuh
Lack of Motivation	Lack of Concern	Kurang perhatian	Lack of Concern	Kurangnya Motivasi pada Pekerjaan	Kurang Berkonsentrasi saat melakukan aktifitas
	Indifferent	Acuh tidak acuh	Indifferent		Tidak tertarik/ tidak peduli/ sikap masa bodoh dengan hasil/ kualitas mutu pekerjaan
	Passive	Pasif	Passive		Pasif/ tidak giat dalam aktifitas pekerjaan
	Uninterested	Tidak tertarik	Uninterested		Tidak tertarik pada aktifitas pekerjaan
Lack of Energy	Spent	Letih	Spent	Kekurangan energi pada Pekerjaan	Merasa kehabisan tenaga saat melakukan aktifitas
	Drained	Terkuras	Drained		Terkurasnya energi saat melakukan aktifitas
	Overworked	Dipekerjaan terlalu keras	Overworked		Terlalu banyak aktifitas yang dikerjakan
	Worn Out	Kehabisan tenaga	Worn Out		Merasa sangat kelelahan hingga kehabisan tenaga untuk melakukan aktifitas lain
Psysical Exertion	Sweaty	Berkeringat	Sweaty	Mengerahkan Tenaga Fisik	Berkeringat
	Out of Breath	Tersengal-sengal	Out of Breath		Mengalami sesak nafas
	Palpitation	Berdebar-debar	Palpitation		Merasa berdebar-debar
	Breathing Heavily	Terengah-engah	Breathing Heavily		Bernafas dengan berat hingga terengah-engah

Table 2. Reliability test results with cronbach's alpha

				If item dropped
	mean	sd	item-rest correlation	Cronbach's α
Q1	1.746	1.655	0.767	0.967
Q2	1.665	1.667	0.835	0.967
Q3	1.254	1.545	0.765	0.967
Q4	1.304	1.514	0.768	0.967
Sleepiness	5.969	5.847	0.834	0.966
Q5	1.571	1.785	0.782	0.967
Q6	1.388	1.696	0.672	0.968
Q7	1.308	1.654	0.748	0.967
Q8	0.728	1.383	0.615	0.968
Physical Discomfort	4.996	5.766	0.774	0.967
Q9	1.424	1.652	0.844	0.966
Q10	0.808	1.370	0.686	0.968
Q11	1.205	1.644	0.805	0.967
Q12	1.031	1.605	0.743	0.967
Lack of Motivation	4.469	5.646	0.840	0.966
Q13	1.424	1.711	0.840	0.966
Q14	1.790	1.833	0.826	0.967
Q15	1.951	1.815	0.817	0.967
Q16	1.545	1.806	0.847	0.966
Lack of Energy	6.710	6.672	0.875	0.966
Q17	1.674	1.732	0.321	0.970
Q18	0.304	0.791	0.503	0.969
Q19	0.701	1.185	0.624	0.968
Q20	0.710	1.239	0.613	0.968
Physical Exertion	3.388	3.920	0.600	0.968

reveal that each item-rest correlation is extremely strong.

According to the results of the validation test for the Indonesian version of SOFI questions using Confirmatory Factor Analysis and the JASP application, all of the Indonesian version of SOFI questions were deemed authentic. This is demonstrated by the CFI and TLI values, which are greater than 0.95, the SRMR value (0.041), which is less than 0.08, and the RMSEA value (0.070), which is less than 0.08.

Following the validity test, the JASP program was used to assess all items in the Indonesian version of the SOFI questionnaire for internal content validation, which included item-rest correlation and Confirmatory Factor Analysis. According to the calculations, all of the questions are valid. It is also feasible to discover which items have the lowest, highest, and most descriptive correlations in each session of the SOFI questionnaire in Indonesian.

In FIGURE 1, the estimation parameters of the 20 questions of the Indonesian version of SOFI, which are classified into 5 dimensions, may be shown in the lowest correlation, maximum correlation, and questions that best characterize the situations in each aspect. Questions are asked in the first dimension (sleepiness). Work tasks that make you tired have the lowest correlation (.849), while searches that make you sleepy have the highest (.849). When you are sleepy/tired when completing activities, there is the strongest link (.955) with the likelihood of enquiries. When completing activities, conditions other than dimension 1 can produce sleeping/tiredness (.089).

The question in dimension 2 (Physical Discomfort) is: The question has the lowest correlation (.713), and the feeling of numbness in body parts has the lowest correlation (.713). The highest correlation (.928) is found in stiff joints, and the possibility of the query is also there. Stiffness in a joint (.139) can be produced by factors other than dimension 2. (Physical Discomfort).

The question Not interested/ don't care/ ignorant attitude with the results/ quality of work has the lowest

Table 3. Validity test results with the JASP application

Fit Indices	Value
Comparative Fit Index (CFI)	0.958
Tucker-Lewis Index (TLI)	0.950
Standardiized root mean square residual (SRMR)	0.041
Root mean square error of approximation (RMSEA)	0.070

correlation (.775) in dimension 3 (lack of motivation), whereas the question Not interested/ don't care/ ignorant attitude with the results/ quality of work has the highest correlation (.775). The strongest correlation (.922) and likely cause is a lack of concentration when doing activities. Other factors can contribute to a lack of concentration when performing activities (.150). (Lack of Motivation).

The question Too much activity is done has the lowest correlation (.844) in dimension 4 (Lack of Energy), the question Feeling tired to the point of running out of energy to do other activities has the highest correlation (.938), and the question Possibility of feeling tired to exhaustion to perform other activities (.119) can be caused by conditions other than dimension 4 (Lack of Energy).

The question Sweating has the lowest correlation (.442) in dimension 5 (Physical Exertion), the question Breathing heavily to gasping for air has the highest correlation (.890), and the possibility of the question Sweating has the highest correlation (.890). Other than dimension 5, situations can cause heavy breathing to gasping for air (.207). (Physical Exertion).

Discussion

SOFI was created in Sweden using the English language to reflect the culture and working environment of the place of origin. Adjustments to the current culture in Indonesia were made as part of the process of converting to the Indonesian translation, as approved by the original authors. This transcultural adaption procedure follows the ISPOR guidelines, which include a ten-step method.

If there are no issues in comprehension or changes in meaning following the reverse translation, the question is accepted as is. However, if a statement turns out to have a different meaning after being translated back, the translation is examined for modifications.

The adjustment method included cognitive debriefing with ten samples of respondents to determine their understanding and comments on the translated

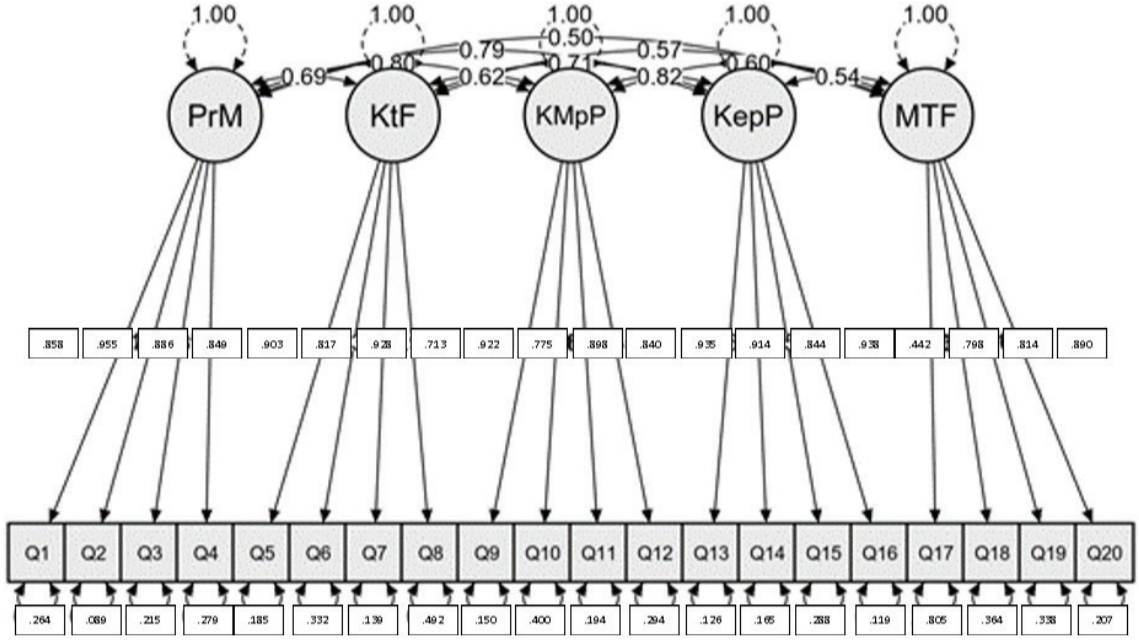

Figure 1. Plot Model Confirmatory Factor Analysis

version of the SOFI questionnaire, which were then discussed with the expert team. Worn Out is the 16th item on the list. "Merasa sangat kelelahan hingga kehabisan tenaga untuk melakukan aktifitas lain," the translation reads. We also clarified numerous terminology in the questions, such as "melakukan aktifitas" or "dalam aktifitas pekerjaan," and added the words "melakukan aktifitas" or "dalam aktifitas pekerjaan," so that they were easy to comprehend and did not create respondents' confusion.

The purpose of this study was to see if the Indonesian version of the SOFI questionnaire was reliable and valid. All 20 items in the Indonesian version of the Swedish Occupational Fatigue Inventory (SOFI) were found to be very good in terms of validity and reliability (-Cronbach 0.969), and the value of the fit index parameter was determined using the JASP application's item-rest correlation test and confirmatory factor analysis. good.

The internal consistency of the SOFI questionnaire was determined through transcultural studies of the adaptation of the SOFI questionnaire into language versions in other countries, and the researchers found that the results were similar to those obtained by the researchers in the Indonesian version. In a study conducted in Portugal in 2017, the value of -Cronbach's alpha was found to be between 0.742 and 0.903. In addition, according to study conducted by Korea in 2021, the -Cronbach value ranges from 0.86 to 0.92. It may be stated that the SOFI questionnaire has strong internal consistency, despite the fact that it was tested in different nations, not just the Indonesian version.

Physical exertion had item-total correlations ranging from 0.321 to 0.624, lack of motivation from 0.686 to 0.844, lack of energy from 0.817 to 0.847, physical discomfort from 0.615 to 0.782, and sleepiness from 0.765 to 0.835. These findings show that each item-rest correlation is highly correlated.

Confirmatory Factor Analysis was used to see how well the five-factor model fit the hypotheses stated in the original study and the data acquired from company employees. With 224 responses, the Indonesian version of the SOFI questionnaire was found to be suitable: CFI = 0.958, NFI = 0.924, RFI = 0.909, IFI = 0.958, TLI = 0.950, and RMSEA = 0.070, 90 percent CI: 0.060 – 0.081. Factor model (224, p 0.001) = 337,649, CFI = 0.958, NFI = 0.924, RFI = 0.909, IFI = 0.958, TLI = 0.950, and RMSEA.The correlated errors of the measured variables that demonstrated the best model fit were determined as variables for the final model after some minor modifications were required.

SOFI can be used by an occupational medicine physician to make suggestions to a company or a worker on which dimensions a worker suffers weariness. So that it can give therapeutic advice and therapy referrals.

Research Limitations

The Indonesian version of the Swedish Occupational Fatigue Inventory (SOFI) Instrument is provided on Google Form, hence there are no limits for this study because it was conducted online.

According to the processes in the ISPOR approach, the translator for the backward translation stage should be an English native speaker who understands the notion of job stress. These requirements were not met due to the lack of a native speaker translator at the time and the limited research time available. The final manuscript, however, contains no changes in meaning or concept, ensuring that legitimate items are obtained.

Conclusion

The ISPOR transcultural adaptation method was used to adapt the Swedish Occupational Fatigue Inventory (SOFI) into an Indonesian version, which included preparation, translation, reconciliation, backward translation, backward translation review, harmonization, cognitive debriefing, cognitive debriefing review, proofreading, and a final report.

All 20 items in the Indonesian version of the Swedish Occupational Fatigue Inventory (SOFI) were found to be very good in terms of validity and reliability (Alpha-Cronbach 0.969), and the value of the fit index parameter was determined to be good in the item-rest correlation test and confirmatory factor analysis using the JASP application.

The 5 (five) dimensions are accurately assessed by all items in the Indonesian version of the Swedish Occupational Fatigue Inventory (SOFI). The Indonesian version of the Swedish Occupational Fatigue Inventory (SOFI) has five dimensions that can be used to assess and diagnose fatigue in employees.

SOFI can be used by an occupational medicine physician to make suggestions to a company or a worker on which dimensions a worker suffers weariness. So that it can give therapeutic advice and therapy referrals. SOFI's application is not restricted to big industrial

Table 4. Result of ISPOR transcultural adaptation into Indonesian version

Original Version		Indonesian Version	
Sleepiness	Yawning	Perasaan Mengantuk (PrM)	Menguap saat melakukan aktifitas (Q1)
	Sleepy		Mengantuk/ Letih saat melakukan aktifitas (Q2)
	Falling Asleep		Merasa akan tertidur saat melakukan aktifitas (Q3)
	Drowsy		Merasa aktifitas pekerjaan membuat mengantuk (Q4)
Physical Discomfort	Tense Muscle	Ketidaknyamanan Fisik (KtF)	Otot merasa tegang (Q5)
	Aching		Rasa Nyeri pada bagian tubuh (Q6)
	Stiff Joint		Sendi mengalami rasa kaku (Q7)
	Numbness		Rasa Mati Rasa/ Baal pada bagian tubuh (Q8)
Lack of Motivation	Lack of Concern	Kurangnya Motivasi pada Pekerjaan (KMpP)	Kurang Berkonsentrasi saat melakukan aktifitas (Q9)
	Indifferent		Tidak tertarik/ tidak peduli/ sikap masa bodoh dengan hasil/ kualitas mutu pekerjaan (Q10)
	Passive		Pasif/ tidak giat dalam aktifitas pekerjaan (Q11)
	Uninterested		Tidak tertarik pada aktifitas pekerjaan (Q12)
Lack of Energy	Spent	Kekurangan energi pada Pekerjaan (KeeP)	Merasa kehabisan tenaga saat melakukan aktifitas (Q13)
	Drained		Terkurasnya energi saat melakukan aktifitas (Q14)
	Overworked		Terlalu banyak aktifitas yang dikerjakan (Q15)
	Worn Out		Merasa sangat kelelahan hingga kehabisan tenaga untuk melakukan aktifitas lain (Q16)
Psysical Exertion	Sweaty	Mengerahkan Tenaga Fisik (MTF)	Berkeringat (Q17)
	Out of Breath		Mengalami sesak nafas (Q18)
	Palpitation		Merasa berdebar-debar (Q19)
	Breathing Heavily		Bernafas dengan berat hingga terengah-engah (Q20)

settings; it may be used to assess and diagnose fatigue in a variety of settings, including physical, cognitive, and mental weariness, as well as acute and chronic fatigue.

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