Original article

Validity and reliability of the Thai-version of Post Stroke Depression Scale (PSDS-T)

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Background: Currently, there has been limited effective and practical instruments for screening post-stroke depression (PSD) in Thailand. In 2014, Post-Stroke Depression Scale (PSDS) has been testified to be a valid and reliable self-rated questionnaire for evaluating Chinese patients with PSD.
Objective: This study proposed to validate the Thai version of PSDS (PSDS-T) in Thai patients with acute ischemic stroke.
Methods: The PSDS was translated into Thai language (PSDS-T). The validity and reliability were tested in 145 acute ischemic stroke patients. Subjects were consecutively recruited to complete PSDS-T; they were clinically evaluated for PSD using DSM-5 diagnosis of adjustment disorder with depressed mood or depressive disorder due to another medical condition by psychiatrists as the gold standard. Cronbach α and point-biserial correlation were respectively used to examine internal reliability and concurrent validity. Then the receiver operating characteristic (ROC) curve was used to determine the cut off score for PSDS-T. The items of the PSDS-T were classified by average clustering analysis.
Results: The Cronbach α of PSDS-T exhibited good reliability (0.780). The point-biserial correlation coefficient between total PSDS-T and the diagnosis of PSD was 0.688. The score of 8 was set to be a cut-off value by ROC analysis with the sensitivity of 0.933 and specificity of 0.908.
Conclusion: PSDS-T is a valid and reliable screening tool for PSD in Thai patients with acute ischemic stroke.

Keywords: Depression, Thailand, psychiatric status rating scales, stroke.

Post stroke depression (PSD) is a common neuropsychiatric disorder mostly found in stroke patients. It affects the rehabilitation, degrades the quality of life, and causes cognitive impairment, increases suicidal rate among stroke patients; it also increases the burden of caregivers. But this condition is often ignored, and undertreated in the common clinical practice.[1]

The cross-sectional prevalence of PSD was estimated to occur in 18.0 – 33.0% of stroke patients.[2] Whereas depressive disorder is found in one-third up to half of all stroke patients during the follow-up period.[3, 4] While the reports from Thailand found the prevalence of PSD between 15.0 to 70.0%.[5] Treatment with antidepressant drug can relieve depressive symptoms as well as restore functional status. Therefore, early detection of depression is crucial and effective strategy in the prevention of PSD during the long-term care.

Nowadays, diagnosing of PSD has not been clearly defined in the international diagnostic system, such as The Diagnostic and Statistical Manual of Mental Disorder, fifth edition (DSM-5), The International Classification of Disease, Tenth Edition (ICD 10) and Chinese Classification of Mental Disorders, third edition. DSM-5 classifies PSD in the group of depressive disorder due to general medical condition with no specific diagnostic criteria for PSD. Hence, most diagnoses in clinical practices based on the clinical manifestation, temporal relationship of depression and onset of stroke, as well as the impact on function after the occurrence of the symptoms.

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Received: February 3, 2020
Revised: March 10, 2020
Accepted: June 24, 2020

Now, there are lots of tools designed for evaluating depressive symptoms in stroke patients, for example, Hamilton Depression Rating Scale (HRDS), Beck Depression Inventory (BDI), Montgomery Asberg Depression Rating Scale (MADRS), Center for Epidemiologic Studies Depression Scale (CES-D), Zung Self-Rating Scale (ZSDS), Patient Health Questionnaire (PHQ-9), Geriatric Depression Screening Scale (GDS). HRDS is the most common tool used to evaluate depressive symptoms in stroke patients; [6] it consists of some physical symptoms which are not actually the depressive symptom. This would decrease the specificity of the tool and cause over diagnosis of PSD. [7]

As for the past decade, many countries in Asia have developed tools for detecting and diagnosing PSD. For example, The Japan Stroke Society developed the "Japan Stroke Scale- Depression Scale: JSS-D" [8] in 2007 and Yue Y, *et al*. developed "Post-stroke Depression Scale (PSDS)" in 2015.[9] After the PSDS was validated in China, it was found that the tool had high sensitivity and specificity for PSD. As yet it was not been validated in Thai. Therefore, we decided to ask for permission to translate and validate for screening PSD in Thai population.

This study aimed to validate PSDS in Thai version with the stroke patients at King Chulalongkorn Memorial Hospital by comparing to clinical diagnosis using the DSM-5 diagnostic criteria of depressive disorder due to general medical condition and adjustment disorder with depressed mood.

Materials and methods

The development of Post-Stroke Depression Scale-Thai version (PSDS-T)

The PSDS, originally developed by Yue Y, *et al*. consisted of 8 items, which included: 1) decrease speech; 2) easy fatigability; 3) easy to cry; 4) insomnia; 5) feeling of decrease capability; 6) suicidal ideation; 7) feeling of difficult to recover; and, 8) more irritable than usual. The questionnaire was self-rated and each item scored from 0 - 4. The higher score represented the more frequent symptoms. The total score was 24 and the cut-off score for depression was more than 6. The Cronbach α of the tool was 0.797, which showed good reliability and the Spearman correlation coefficient between PSDS and HDRS was 0.822, indicated good congruent validity.

The authors received the permission from the copyright from the owner to translate and validate this instrument in Thai language. The test was forward and backward-translated by an expert translator, who had no responsibility in other parts of this study. The content validity was examined by two senior psychiatrists and one senior neurologist. The calculated Item-Objective Congruence Index (IOC) of each items more than 0.5 were accepted. The validity and reliability were later analyzed.

This cross-sectional study has been approved by the Institutional Review Board, Faculty of Medicine, Chulalongkorn University (no. 334/61) and was carried out from June 2018 to July 2019. One hundred and fifty-nine subjects were consecutively enrolled from the In-patient Stroke Unit of King Chulalongkorn Memorial Hospital, Bangkok, Thailand. All subjects were diagnosed with acute ischemic stroke by neurologist with age of over 20 years old, and were able to read and communicate in Thai understandably. Patients who had anosognosia, neglect, hemianopia, cortical blindness, amnesia, aphasia, bilateral blindness or deafness, severe cognitive impairment with the score of the Thai Mental State Examination (TMSE) less than 10, history of major depressive disorder or dysthymia diagnosed by psychiatrists were excluded from this study. All subjects were given written informed consent before completing the PSDS-T questionnaire within 24 hours before discharge.

The post stroke depression in this study was evaluated by psychiatrists and defined by using clinical diagnosis of DSM 5 depressive disorder due to another medical condition or adjustment disorder with depressed mood.

Statistical analysis

IBM SPSS statistics version 22 software was used to calculate the reliability, validity and cluster analysis of PSDS-T. Data were expressed as mean ± standard deviation (SD). P – value < 0.05 was considered as statistically significant difference. The statistical analysis were performed for the internal consistency of each item using Cronbach α coefficient, the point biserial and Kruskal-Wallis test for the concurrent validity and the sensitivity, specificity and area of receiver operating characteristic (ROC) curve to determine the cut-off score for post-stroke depression. The K-means cluster analysis was also performed to categorized items into groups.

Results

One hundred and forty-five acute ischemic stroke patients were included in the study. There were 130 stroke patients without depression (90.6%) which consisted of 72 males and 58 females with a mean age of 62.47 (SD = 12.9) years old and 15 post-stroke depression patients (9.4%) which consisted of 6 males and 9 females with a mean age of 62.34 (SD = 12.8) years old. These meant the prevalence of depression in hospitalized patient with acute ischemic stroke in this study was 11.5%. There was no significant difference of sociodemographic data between the two groups. Details are described in Table 1. The patients with depression trended to have longer length of stay, higher National Institute of Health Stroke Scale (NIHSS) score and modified ranking scale, poorer cognitive performance from TMSE score and more frequent history of previous mood disorders comparing to patients without depression as shown in Table 2.

Table 1. Socio-demographic characteristics of study sample.

Characteristics	Patients with post-stroke depression (n = 15)	Patients without depression (n = 130)
Gender (n %)		
Male	6 (40.0)	72 (55.4)
Female	9 (60.0)	58 (44.6)
Age (years)		
Mean (SD)	66.5 (16.6)	62.5 (12.9)
Marital status (n, %)		
Single/widowed/divorced	3 (20.0)	32 (24.6)
Married	12 (80.0)	98 (75.4)
Educational level (n, %)		
Primary	4 (26.7)	52 (40.0)
Secondary	5 (33.3)	41 (31.5)
Bachelor and higher	6 (40.0)	37 (28.5)

Table 2. Stroke-related factor of study sample.

Characteristics	Patients with Post-stroke depression (n = 15)	Patients without depression (n = 130)
Onset to admission time (hours) Mean (SD)	9.6 (8.4)	19.9 (29.8)
Length of stay (days)* Mean (SD; min-max)	20.0 (26.5)	7.5 (12.4)
Lesion (n, %)		
Hemisphere	7 (46.7)	50 (34.7)
Left hemisphere	2 (13.3)	23 (16.0)
Subcortical structure	7 (60.0)	70 (53.9)
Brainstem	3 (20.0)	25 (19.2)
NIHSS* Mean (SD)	6.4 (5.7)	2.9 (3.7)
Modified Ranking Scale (mRS)		
Grade 0 - 2	7 (46.7)	93(71.5)
≥ Grade 3*	8 (53.3)	37 (28.5)
TMSE* Mean (SD)	18.4 (6.6)	25.4 (4.5)
History of previous stroke (n, %)	7 (46.7)	44 (33.9)
Family history of stroke (n, %)	1 (6.7)	16 (12.3)
History of previous mood disorder* (n, %)	3 (20.0)	5 (3.9)
PSDS-T* Mean (SD)	13.3 (4.1)	3.8 (3.0)

*$P < 0.05$, NIHSS = National Institute of Health Stroke Scale, TMSE = Thai Mental State Examination, PSDS = Post-Stroke Depression Scale-Thai version

Reliability

Cronbach α was used to estimate the reliability of scales. The Cronbach α was 0.780 (95% CI 0.722 - 0.831), which exhibited that PSDS-T had good reliability due to good internal consistency.

Validity

The calculated Item-Objective Congruence Index (IOC) were 1.0 for all 8 items. All data were used to calculate the point-biserial correlation of total PSDS-T score and clinical diagnosis of post-stroke depression. The correlation coefficient was 0.688 ($P < 0.001$) which showed a good concurrent validity. The point-biserial correlation coefficient between each item and total score of PSDS-T is listed in Table 3. All items correlated with the total score significantly. The value showed that PSDS-T had good internal consistency. The point-biserial correlation coefficients of feeling of decreased capability, suicidal ideation, and more irritable than usual was larger than 0.5 with both the total score and the diagnosis of post-stroke depression, so these three items were thought to be more specific characteristics of depression in an acute stroke patient. Insomnia, easy fatigability and feeling difficult to recover were the less specific characteristics of post-stroke depression patients. Then, Kruskal-Wallis test was used to measure the equality of medians between patients with and without depression after stroke. The result showed that mean PSDS-T scores were significantly different between both groups with a significant effect on estimating depression in a stroke patient ($P < 0.001$). The boxes plot of the stroke patients with depression and without depression display that the two median line have a far distance between the two groups (Figure 1).

The cut-off of PSDS-T was 8 by the ROC curves with the sensitivity of 0.933, specificity of 0.908, positive predictive value (PPV) of 0.910 and negative predictive value (NPV) of 0.931, made it a good screening tool. Figure 2 demonstrates the ROC curve of PSDS-T. The PSDS-T area under the line is 0.957 ($P < 0.001$: 95% CI). The result demonstrates that PSDS-T has a good diagnostic accuracy.

Next, K-means clustering analysis, which extracted the factors of post-stroke depression was done. Eight were divided into three parts. Part 1 was decreased speech, suicidal ideation, easy to cry, easy fatigability and more irritable than usual; Part 2 was feeling of difficult to recover and feeling of decreased capacity; Part 3 was insomnia. Therefore, Part 1 was named as "Deteriorating Factor". Part 2 was named as "Reactive Factor". Part 3 was named as "Sleep-Related Factor" (Figure 3) .

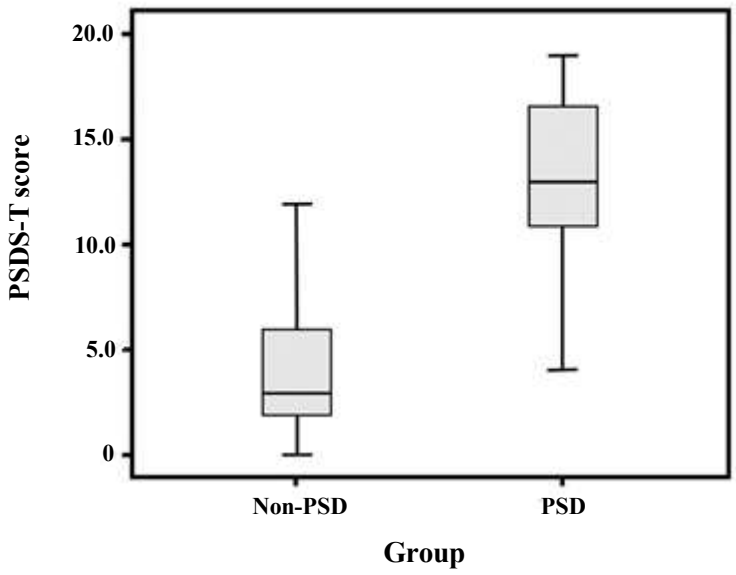

Figure 1. The box plots of patients with and without depression after stroke, the result of Kruskal-Wallis test showed a significant difference between two group (PSD and non-PSD, $P < 0.001$).

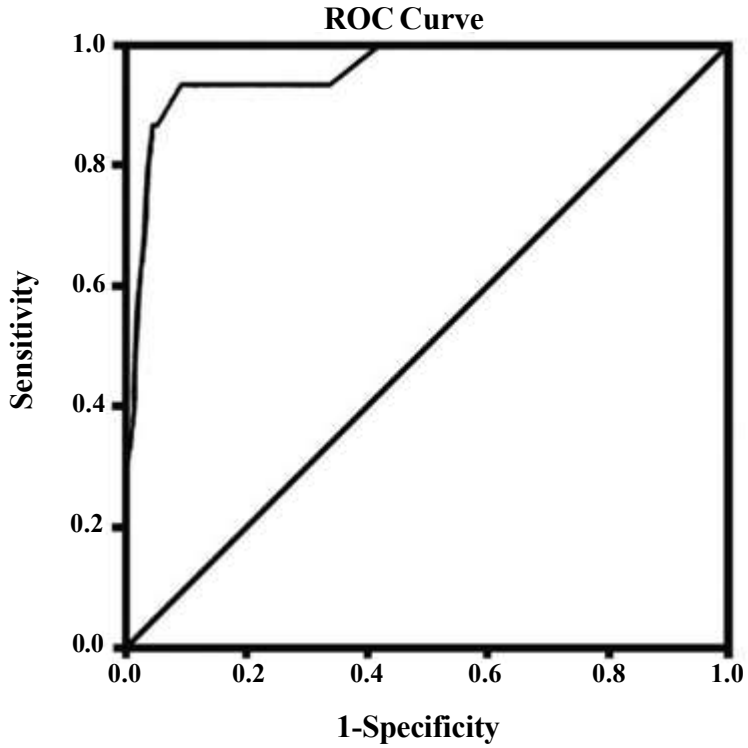

Figure 2. PSDS-T score ROC curve for PSDS-T which area under the lines were 0.957 ($P < 0.001$: 95% CI, 0.913 - 1.000).

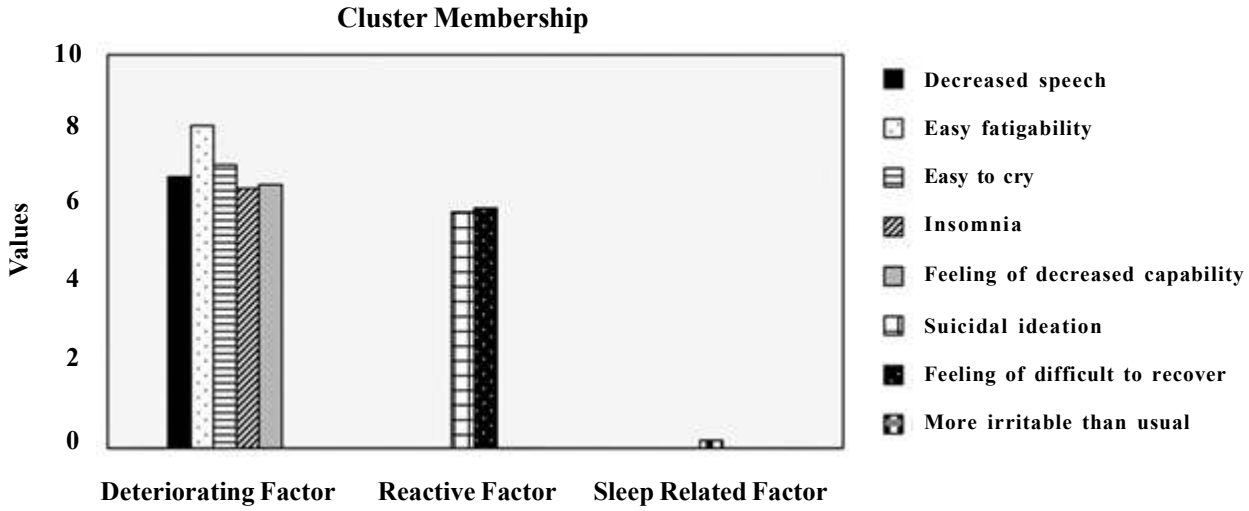

Figure 3. PSDS-T was divided into three groups by K-means clustering analysis.

Table 3. The results of Point-biserial correlation of PSDS-T.

	Decreased speech	**Easy fatigability**	**Easy to cry**	**Insomnia**	**Feeling of decreased capability**	**Suicidal ideation**	**Feeling of difficult to recover**	**More irritable than usual**	**PSDS-T (score)**	**Diagnosis of Post-Stroke Depression**
Decreased speech	1.000	0.352*	0.087	0.277**	0.380**	0.303**	0.301**	0.482**	0.621**	0.446**
Easy fatigability	-	1.000	0.207*	0.198*	0.339**	0.248**	0.153	0.351**	0.569**	0.352**
Easy to cry	-	-	1.000	0.197*	0.418**	0.340**	0.382**	0.392**	0.580**	0.502**
Insomnia	-	-	-	1.000	0.214**	0.276**	0.153*	0.330**	0.538**	0.193*
Feeling of decreased capability	-	-	-	-	1.000	0.432**	0.472**	0.446**	0.736**	0.568**
Suicidal ideation	-	-	-	-	-	1.000	0.219**	0.463**	0.625**	0.555**
Feeling of difficult to recover	-	-	-	-	-	-	1.000	0.447**	0.637**	0.377**
More irritable than usual	-	-	-	-	-	-	-	1.000	0.764**	0.564**
PSDS-T (score)	-	-	-	-	-	-	-	-	1.000	0.688**

*Correlation is significant at P - value < 0.05.

Discussion

PSDS was developed by Yue Y, *et al*. in 2015, as a reliable and valid screening tool for post stroke depression patients in China.[9] Since there has been a lack of screening tool for this condition precisely and correctly in Thailand,[10] so the author was interested in translating PSDS into Thai version, and testing for the reliability and validity of the tool in Thai patients with acute ischemic stroke.

Nowadays, existing tools, for example, HAMD, MADRS, GDS and BDI, were used for diagnosing post-stroke depression in several studies, which may cause some errors in the diagnosis of depression in patients with stroke.[11 - 13] As for some items in these tests could be confounded with the symptoms of stroke. These symptoms included psychomotor retardation, fatigue or problems with sleep and appetite were demonstrated that they were not reliable indicators for diagnosis of depression in the elderly. [14, 15]

Our result showed that PSDS-T had a good internal consistency and a good concurrent validity according to the value of alpha Cronbach coefficient and the point-biserial correlation between PSDS-T and clinical diagnosis by using DSM-5 criteria, respectively.

The area under ROC curve could show a rational index of the whole diagnostic precision of this tool. The cut-off value of PDSD-T was 8 which was higher than the cut-off value of PDSD in the original version that was 6.[9] This may be due to the characteristics of the sample, types of stroke and the duration of assessment of the original study were different from ours. We recruited only acute ischemic stroke patients, whereas the prior study included both ischemic and hemorrhagic stroke patients, and also, subacute and chronic cases.

In clustering analysis, we found that the items of PSDS-Thai could be grouped into 3 clusters: deteriorating, reactive, and sleep-related factor; these were similar to the Chinese version reported from Yue Y, *et al*. [9] The first cluster was deteriorating factor representing the patient's decreased physical competency that leaded to worsen mood and behavior and eventually deteriorated adaptive function. The second cluster was reactive factor reflecting the patient's self-perception of his or her disability as a reaction to consequence of stroke. Concerning this factor, we asked the patients to recall their course of illness 24 hours prior to discharge from the hospital whether they had a feeling of decreased capability or feeling difficult to recover, which were commonly reported–among our sample. Moreover, the biserial correlation coefficient analysis revealed strongest positive correlation between the feeling of decreased capability and the diagnosis of PSD. The last cluster was the sleep-related factor which included only insomnia, the common symptom reported among typical stroke patient (20.0 – 59.0%).[16] This sleep-related factor could be contributed by both the symptom of stroke and external or environmental factors which were commonly found in the acute stroke unit setting such as intensive vital sign monitoring, and use of the medication.

The prevalence of post-stroke depression in this current study is lower than previous reports.[17, 18] It might be due to the difference of screening tool for the diagnosis of PSD. Former studies used various questionnaires such as HAMD; MADRS and GDS, whereas our study used clinician interviews. [11] The duration of illness may be one contributing factor for the diversity. The post-stroke depression may be found about 30.0% within 1 to 6 months after stroke events [19], but all subjects in this study were assessed before one month after the onset of stroke. Furthermore, the omission may cause by the strict exclusion criteria of our study which exclude patients with severe language and cognitive deficit who would have depression that could not be measured by using PSDS-T which was a self-rated questionnaire.

According to demographic data, it was founded that related factors of PSD were the NIHSS and mRS score, history of previous mood disorder, duration of length of stay and-TMSE score. This finding was consistent with meta-analysis of Shi who found that previous mood disorder, severity of stroke, level of handicap, and level of independence were all risk factors of depression especially during the first three months after the onset of stroke.[20] We found that the average TMSE score among non-PSD group was higher than PSD group indicated that PSD was associated with increased cognitive impairment and consistent with the earlier study found that the prevalence of cognitive impairment after PSD is common around 35.2 – 87.0%.[21] The average length of stay of PSD group were significantly longer than that of non-PSD group, which was consistent with the study of Nidhinandana that found the duration after stroke onset is one of the risk factors most consistently associated with depression after stroke. [5]

It can be concluded that PSDS-T is a practical screening tool for PSD, which had good validity and reliability. According to meta-analysis by Meader, PSDS has an advantage of having fewer items than CES-D and HDRS, making it less time-consuming for clinical use.[11] Furthermore, while PHQ-9 is a good screening tool for major depression, it is not quite suitable for mild to moderate depression according to meta-analysis by Burton and Tyson. [22] In this study, PSDS-T could be used to screen adjustment disorder with depressed mood and depressive disorder due to another medical condition with depressive feature, which are considered mild to moderate depression, with high sensitivity and specificity. Therefore, PSDS-T can be used as a screening tool for depression of any severity.

The strength of this study was having a large enough sample size to have good accuracy and greater confidence including lower margin of error. However, the validity and reliability was only tested in acute ischemic stroke admitted at stroke unit. There would be some limitation to generalize the usage of PSDS-T in patients with hemorrhagic stroke, sub-chronic or chronic cases, patients with dyslexia or aphasia.PSDS-T is designed for screening post-stroke depressive disorder, and not for clinical diagnosis. PSDS-T also has limitation in differentiating whether the etiology of depressive disorder after stroke is due to the neuropsychiatric manifestation of stroke or the relapse of underlying depressive disorder. Since the patients with underlying depressive disorder were excluded from this study , it can be certain that the majority of this sample would be DSM- 5 depressive disorder due to general medical condition. As for the application of PSDS-T in clinical practices, more comprehensive clinical assessment is needed for definite diagnosis and planning for management which will later determine the outcome of treatment and prognosis for the patients.

Conclusion

Post-stroke depression is a common neuro-psychiatric consequence in stroke patients and affects their functional recovery, social outcome, quality of life including morbidity and mortality. Therefore, the more earlier this condition be found, the higher chance of recovery increases. Our report found that PSDS-T may be helpful for screening depression after acute ischemic stroke in order to receive early treatment. For further study, generalizability of the result in other stroke population should be more investigated.

Acknowledgements

We wish to thank all the subjects in this study and would like to pass our special thanks to Professor Dr. Michael Maes, Dr. Mayteewat Chiddaycha and Miss Ketsupar Jirakran for their valuable consultation and advices throughout the study.

Conflict of interest

The authors, hereby, declare no conflict of interest.

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