

A preliminary study of the original TIBSIT and its cultural adaptation in Malaysia

Kevin Suresh Doshi, Ms (ORL-Head & Neck Surg)¹, Revadi Govindaraju, Ms (ORL-Head & Neck Surg)¹, Mahmoud Danaee, PhD², Tengku Ahmad Shahrizal, Ms (ORL-Head & Neck Surg)¹, Prepageran Narayanan, FRCS¹

¹Department of Otorhinolaryngology, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia, ²Department of Social and Preventive Medicine, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia

ABSTRACT

Background: A simple and self-administered 'scratch & sniff' test kit like the TIBSIT smell kit based on the Taiwan Smell Identification Test (TWSIT), provides a safe and quick assessment of olfaction. The original TIBSIT has been validated for use in Taiwan with age specific scores for different age groups and diagnosis. The main aim of this study is to examine if TIBSIT can be applicable for the Malaysian population and perform cultural adaptation as necessary to allow a more accurate assessment using this tool.

Method and Material: A preliminary study of the original TIBSIT (Phase 1) followed by cultural adaption (Phase 2) were carried out on volunteers from various neighbourhoods in Klang Valley, Malaysia comprising of age group 16-80 years. A total of 150 test subjects and 50 test subjects were recruited for Phase 1 and Phase 2 respectively. Cultural adaptation was done with changes to the distractors that were found to be confusing. In addition, modifications included added language translation and visual reinforcement with images of the odour's substance of origin.

Results: 109 out of the 150 responses were accepted for Phase 1. A detection rate of less than 75% was found in three of the odours with the remaining showing an average rate of 87.2% to 97.7%. These three odours were culturally adapted for Phase 2. All 50 responses for Phase 2 were accepted; two of the odours' detection rates improved to 98% but the plum odour was only detected 53% of the time.

Conclusion: TIBSIT provides a quick office-based olfaction testing. The culturally adapted test kit is a potentially useful screening test for the Malaysian population. It is also safe and excludes the need of the clinician to carry out the test. This becomes especially useful in testing any dysosmia (hyposmia/anosmia) cases suspected of SARS-COV-2 virus infection (COVID-19).

KEYWORDS:

Smell test kit, scratch and smell test, anosmia, hyposmia, olfactory dysfunction, olfactory psychophysical test, COVID-19

INTRODUCTION

The sense of smell or olfaction is one of the five basic senses of human being. Smell provides enjoyment of scents and

influences taste of food. It can give information about the surrounding, and act to protect such as warn us of nearby danger/smoke/toxic fumes. Any alteration to it, temporary or permanent, will disrupt the quality of life and can lead to psycho-emotional stress.¹

Olfaction disorders are sometimes overridden by disorders of the other senses like vision and hearing. They can be underdiagnosed by the clinician or not even perceived as an important symptom needing to report by the patient. There are numerous causes that may give rise to dysosmia, and with the pandemic occurrence of SARS-COV-2 virus (COVID-19) as one causative agent, it becomes more relevant to give importance to olfactory testing. However, it is well accepted that smell perception and identification is culturally different and relates closely to memory and familiarity. A reliable test should take into account this important factor apart from being reproducible.

Commercially popular smell test kits such as Sniffin' Sticks and University of Pennsylvania Smell Test (UPSIT) developed in Europe and America are well established psychophysical smell assessment.^{2,3} Both tests have undergone cultural adaption in several countries followed by normative data collection for the specific population to validate its use. The results of validation studies have shown gender and age variations for a healthy population and different cut-off points to differentiate normosmia from hyposmia and anosmia.³ However, in Malaysia, such data is not yet available at our disposal for a routine use, though the cultural adaption for the Sniffin' Sticks has been performed by a team from another institution and by the authors institution.⁴

The Top International Biotech Smell Identification Test (TIBSIT) test kit/booklet is a self-administered 'scratch and sniff' smell test kit from Taiwan. It is a rebranded version of the Taiwan smell identification test (TWSIT) which uses amber jars containing the liquid odorants.⁵ TIBSIT is a sealed booklet questionnaire that has embedded fragrant microcapsule on individual pages.

As the COVID-19 pandemic evolved and dysosmia (anosmia/hyposmia) was recognized as one of the early symptoms, smell testing became important.⁶ However, due to the transmission mode of the infection with SARS-COV-2, administering a face-to-face test that is also time-consuming such as Sniffin' Sticks may not be feasible. A self-

Corresponding Author: Revadi Govindaraju
Email: revadi@um.edu.my

administered test would be the preferred option, and therefore the objective of this study was to validate this new kit. As it was developed in an Asian country it would be suitable as most odorants if not all are likely to be familiar to Malaysians. The original TIBSIT has been validated for use in Taiwan with age specific scores for different age groups and diagnosis.⁷ We study the applicability of the original TIBSIT test kit and after being culturally adapted for the Malaysian population, for the objective assessment of smell deficits.

MATERIAL AND METHODS

A cross sectional study of asymptomatic volunteers from various neighbourhoods of the Klang Valley, Malaysia was conducted from July 2020 to April 2021. A convenient sampling of the general public was the chosen method, comprising from the age group of 16 to 80 years.

The inclusion criteria for the purpose of this study were Malaysian citizens aged 16 years and above, with no reported smell impairment and excluded any subjects with perceived smell disturbances of any cause, recent upper respiratory tract infections and any other known nasal or skull base or intracranial diseases. An informed consent was obtained from all participants for a voluntary participation with no monetary incentive or otherwise offered in exchange.

Top International Biotech Smell Identification Test (TIBSIT)

The TIBSIT test kit (International Biotech Co., Ltd., Taipei, Taiwan) consist of a 16 page odour booklet and a questionnaire at the back of the booklet. The first eight odorants in question 1-8 (1st part) are the same as questions 9-16 (2nd part) but in a different order. Each page has one "scratch-and-sniff" blue strip. The fragrant microcapsule is made of melamine, formaldehyde and fragrant oil by condensation polymerization. This process prevents the fragrant oil from evaporating and thereby allowing storage for two years.⁷

After a brief explanation on the test, each test subject is then asked to perform the test without any assistance by the medical personnel by simply scratching onto a blue rectangle area consisting the fragrant microcapsules with a pencil and smelling the fragrance released from the microcapsule. As best as possible, the test is carried out in a well ventilated room. The subject is asked to refrain from ingesting any solid foods or liquid prior and during the test. This includes chewing gum and smoking cigarettes. There is no time limit for the test, only a one minute compulsory break included between 1st part and 2nd part of the questionnaire. During this 1 minute break, the test subject is asked to shade or blacken a small rectangular box (6cm x 3.5cm) found after odour number eight.

After the subject sniffs an odour, they answer the corresponding questions to identify and rate its detectability. Each main question thus contains two sub-questions, namely part A and part B. Part A is a four-choice odour identification question where the subject needs to select one of the given options. Part B is a three-item question, "not detectable" meaning one can smell nothing at all, "detectable, but not sure" meaning one can smell something but unsure of the

smell, and "detectable" meaning one can smell and know exactly what smell it is. All test subjects are reminded prior to starting, to attempt to answer all the questions, even if they fail to detect anything.

Scoring of TIBSIT

When completed, the TIBSIT booklet is collected and a specified scoring system is applied to each response given by the test subject. For part A, the scoring system gives one (1) point for each correctly identified odour and zero (0) if identified wrongly. For part B, the scoring system gives zero (0) points for "not detectable" and one (1) point for "detectable, but not sure". For part B, the scoring system gives two (2) points for "detectable" provided the odour is correctly identified in Part A. If however, the odour is incorrectly identified in Part A, then "detectable" in part B gets zero(0) points. Thus, for each odour tested, the combined score can range from zero (0) to three (3). As such, the maximum point attainable for each completed test kit is 48 points.

Phase 1-Original TIBSIT

A total of 150 test subjects were recruited for this Phase 1. The objective of this exercise was check the feasibility of the using the original TIBSIT test kit for the sample population. The tests were conducted and scored in the same manner as detailed above. The language options available were Mandarin and English, as per the original test kit.

Phase 2-Cultural adaptation of TIBSIT (mTIBSIT)

A total of 50 test subjects were recruited for this Phase 2, again following the inclusion criteria. This limitation of sample size was due to availability of smell kit. The cultural adaptation was carried out to address the odour(s) that gave an identification rate of less than 75% in Phase 1 of the study. Although the odours remained the same within the tests, the distractors were changed to aid in better disparity to the particular odour tested. In addition, visual reinforcement of the odour's substance of origin was shown for each question. Language translation to Bahasa Malaysia (primary language of Malaysia), was given together with the English language.

Statistical analysis

SPSS Version 27 was used for analysis. Descriptive analysis was done for the demographic data. Specific odour detection rate (frequency) was analysed for TIBSIT and mTIBSIT. The two-time odour identification and the combined scores for each odour was analysed using cross tabulation and tested for internal consistency (ICC) for both TIBSIT and mTIBSIT.

RESULTS

The demographic details are available in Table I for both Phase 1 and 2 of the study. Mean age of participants were 38.03 ± 13.598 for the original TIBSIT group and 40.42 ± 11.741 for the mTIBSIT group, with a female preponderance in the original TIBSIT group.

Phase 1-Original TIBSIT

Out of the 150 samples, only 109 were included for the data analysis (22 failed to return the completed smell kit and 19 subjects gave incomplete answers).

Table I: Participant characteristics for both the study of the original TIBSIT and post-cultural adaptation (mTIBSIT)

Participant characteristics	Original TIBSIT	mTIBSIT
Number of participants	109	50
Age (years), (mean ± SD)	16-80 (38.03 ± 13.598)	20-76 (40.42 ± 11.741)
Gender (F, M)	n=70,39; 64.2 %, 35.8 %	n=21,29; 42%, 58%
Smoking status (Y, N)	n=9,109 ;8.3%,91.7%	n=2,48; 4%, 96%

Table II: Percentage detection rate for the odour in the TIBSIT study

Odour ID	Original TIBSIT (n=109)		mTIBSIT (n=50)	
	Percentage detection rate (test, retest)	Average detection rate	Percentage detection rate (test, retest)	Average detection rate
Honey peach	89.0%, 85.3%	87.2%	90.0%, 94.0%	92.0%
Passion fruit	92.7%, 89.9%	91.3%	96.0%, 96.0%	96.0%
Cantaloupe	70.6%, 54.1%	62.4%	98.0%, 98.0%	98.0%
Lemon	72.5%, 80.7%	76.6%	98.0%, 98.0%	98.0%
Plum	56.9%, 65.1%	61.0%	54.0%, 52.0%	53.0%
Coffee	90.8%, 92.7%	91.8%	94.0%, 92.0%	93.5%
Jasmine	94.5%, 94.5%	94.5%	98.0%, 96.0%	97.0%
Garlic	98.2%, 97.2%	97.7%	100.0%, 100.0%	100.0%

Table III: Results of test -retest reliability (ICC) for repeat identification of odours and also the combined score in the original TIBSIT and post-cultural adaptation

	Original TIBSIT				mTIBSIT			
	OID answers (Crosstab)		OID* (Part A)	Combined scores* (Part A + B)	OID answers (Crosstab)		OID* (Part A)	Combined scores* (Part A + B)
	Correct both times	Wrong both times			Correct both times	Wrong both times		
Honey Peach	79.8%	5.5%	.517	.568	88.0%	4.0%	.634	.621
Passion fruit	88.1%	5.5%	.750	.728	92.4%	0.0%	NA	.589
Cantaloupe	48.6%	23.9%	.626	.733	96.0%	0.0%	NA	.339
Lemon	66.1%	12.8%	.596	.622	96.0%	0.0%	NA	.465
Plum	49.5%	27.5%	.692	.812	42.0%	36.0%	.717	.666
Coffee	87.2%	3.7%	.567	.702	88.0%	2.0%	.379	.254
Jasmine	90.8%	0.9%	.244	.297	96.0%	2.0%	.797	.964
Garlic	97.2%	1.8%	.887	.892	100%	0.0%	NA	NA

OID: Odour identification;

Crosstab: Cross tabulation analysis

* ICC

NA: Due to low variability between test and retest

Three odours were noted to have less than 75% detection rate at least once within the same test during the study and therefore underwent change of the distractors for the subsequent Phase 2 study. The rest of the odours had a detection rate ranging from an average of 87.2% to 97.7% (Table II).

Phase 2-Cultural adaptation of TIBSIT (mTIBSIT)

Distractors were changed once for Question 3A (honey peach changed to durian) & Question 4A (garlic changed to coconut). Distractors for Question 5A & 15A were changed 3 times as the following description: 1st (jasmine changed to black tea; honey peach to gasoline & mango changed to rose), 2nd (jasmine was changed to coffee), 3rd (jasmine was changed to screw pine leave: honey peach changed to kaffir lime & mango changed to durian). This improved the detection rate for both cantaloupe (98%) and lemon (98%), however the detection rate for plum remained poor at an

average of 53% (Table II). The distractors were mainly changed based on a 70-item odour familiarity survey done on 98 participants for a previous study involving Sniffin' Stick test in authors' institution [unpublished data].

The internal consistency for repeat detection of the same odour and detectability within the same test showed acceptable agreement for all odours except Jasmine in the original TIBSIT study. This occurred despite a consistently correct answers obtained both times in 90.8% of subjects. In the Phase 2 of the study, the agreement was similarly seen for test odours, but coffee showed lowered consistency for this sample even though the consistency in detection was almost like the Phase 1 (Table III).

Overall the total score also showed improvement with improved detectability of the odours after cultural adaptation. Total score ranged from 15-48 (Mean 38.36 ± SD

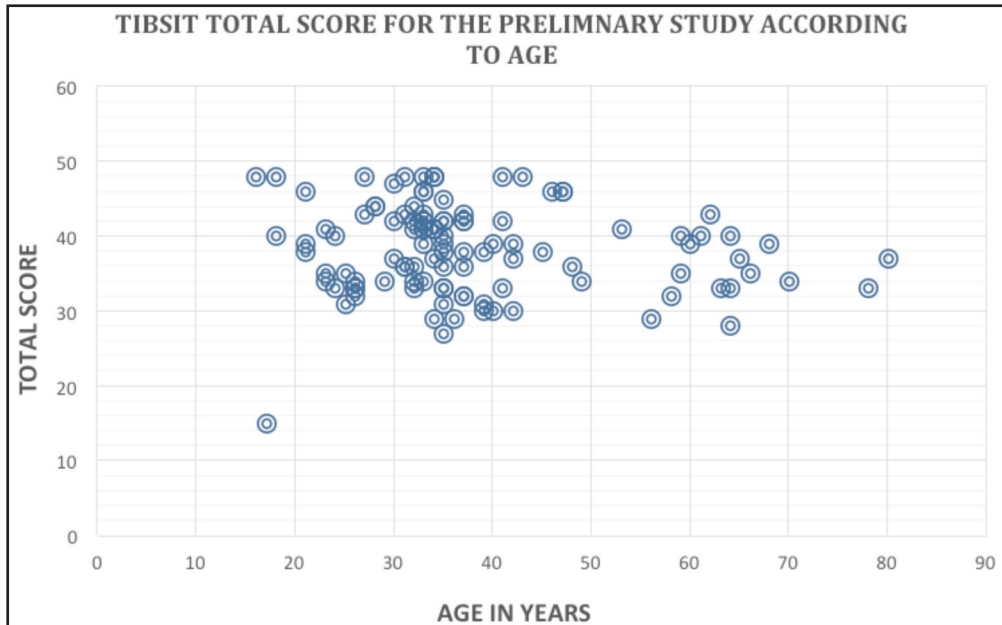


Fig. 1: Total score for the TIBSIT test for each participant in the preliminary study according to the age.

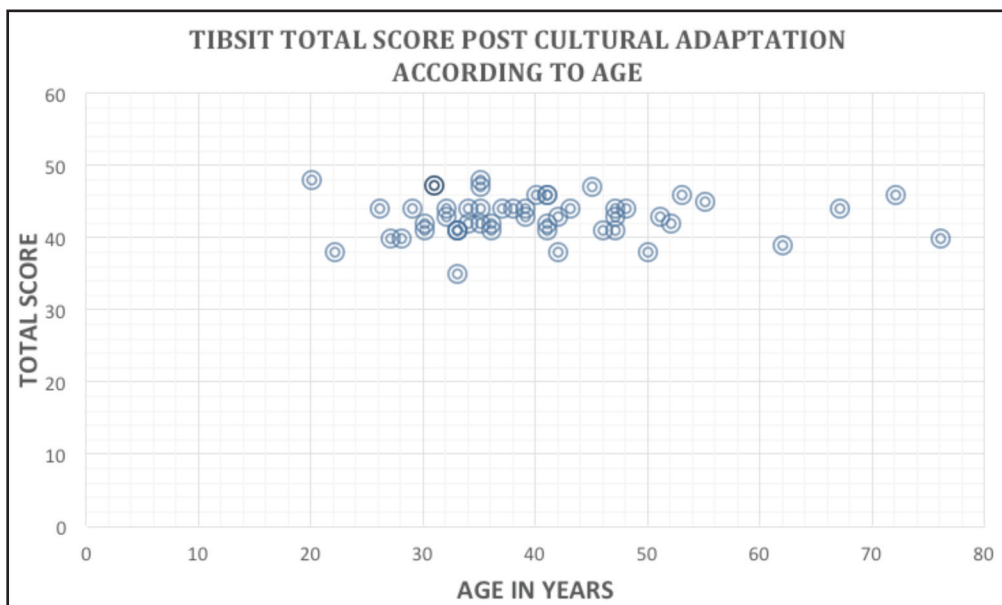


Fig. 2: Total score for the TIBSIT test for each participant post-cultural adaptation according to the age.

5.996) for the original TIBSIT and 35-48(Mean 42.86± SD 2.777) post cultural adaptation (Fig. 1& Fig. 2). Age or gender specific scores were not analysed in this preliminary study.

DISCUSSION

This new smell kit is a self-administered scratch and smell identification test with forced choice answers like the UPSIT but with fewer odorants tested (n=8 versus 40).¹ In contrast, the Sniffin’ Sticks test includes assessment of all 3 components of olfaction; threshold, discrimination and

identification of odors using felt-tipped pens delivering the odour and is administered by a physician.³

There are also several other self-administered smell identification tests developed in the Europe and America that mainly vary in the number of odours tested such as the Smell Diskettes olfaction test (8 odours with visual reinforcement), Cross-Cultural Smell Identification Test (12-item version of UPSIT), 8-items Sensonics Smell Test, 4-items pocket smell test and Q-SIT (3-item smell identification test, not strictly forced choice).^{1,8,9} However, none have a culturally adapted data for Malaysians.

TIBSIT additionally has add-on item (Part B) that also assesses the subjective sensations of the odour irrespective of the familiarity of the odours. Therefore, a patient can indicate if no smell is perceived for the odour tested. The scoring system allows identifying this condition as anosmia and suspect a potential malingerer based on the subjects answer for the smell identification in Part A. Garlic has a pungent trigeminal stimulating odour which may still be detected by a person which olfactory disturbance.⁵ The scoring system is such that the probability of a genuine patient scoring all 0 for identification is low but this could happen if the person is malingering. Therefore, it could serve as a ground for suspecting the condition.

In contrast to other commercially available test, the test odours are also repeated in different sequence within the same booklet to retest the subjects for consistency in their answers.

This new smell kit has shown similar requirement for cultural adaptation despite being produced in another Asian country. The detection rate was good for most odours though the lemon oil was strangely confused with garlic. Removing garlic as a distractor immediately improved the detection rate to 98%. Cantaloupe has a distinct smell, but this too was confused with honey peach requiring the change of the distractor, eventually improving the detection rate to 98%. This is perhaps also contributed by the Malay language translation and visual reinforcement with images of the substance of origin.

However, the plum, though easily available and consumed by many urban Malaysians, showed poor detectability in this study. Despite changing the distractors 3 times, the detection rate was poor. This is perhaps due to the indistinct smell of raw plum. The new distractors used for the plum odour were common local food items with peculiar and distinguishable smell such the screw pine leave (pandan), kaffir lime and durian. Despite that, about the half the participants struggled to choose the right answer.

The scratch and sniff test are new in the Malaysian setting. The test uses forced choice answers. In the event of non-familiarity of the scent, this sort of test also evaluates the ability to eliminate the impossible choices and thereafter choose a likely answer. Our observation noted that many participants were forcing themselves to choose the most likely familiar smell instead.

The Part B of the test requires a response if a smell was detectable, detectable but the participants are unsure of the smell and lastly if no smell is detected as in the case of anosmia. The second observation that we noted is that several participants (n=19) completely missed answering the Part B if all odours were familiar to them (their data was removed from analysis). In another set of subjects, detectability was equated with getting the answer correct. In this group of subjects, if the smell was not familiar then it was scored as non-detectable instead of detectable but unsure. Therefore, this affected the overall score.

However, this confusion was resolved with better instructions given out in the print form in both the Malay and English language. This is reflected in the improved mean total score of the test in Phase 2.

Test-retest are often done with longer intervals of days to weeks, however, we restricted to the 1-minute interval as instructed by the original investigator. Using this time frame, there was an acceptable agreement between test and retest values for the same odours.

Taking all the above factors into account, familiarity and answering attitudes, most likely the plum odour may need replacement in future booklets to achieve a better total score.

The limitation of this study is the availability of the samples of the smell kit thereby limiting the sample size for a more robust validation study. This includes a process of validation study that includes a formal forward and backward translation process, inclusion of population who have smell disturbances and test-retest reliability of the entire test. A further detailed study of a validated kit would allow data collection for a Malaysian normative value according to the age and gender.

CONCLUSION

TIBSIT provides a quick office-based olfaction testing. In the absence of other available equivalent test, the culturally adapted test kit is a potentially useful screening test for the Malaysian population. It is also safe and excludes the need of the clinician to carry out the test. This becomes especially useful in testing any dysosmia (hyposmia/anosmia) cases suspected of SARS-COV-2 virus infection. Further modification may be necessary to substitute the plum to a more locally familiar scent, to increase detection rate and finally to enable a normative data to be established for the Malaysian population.

ACKNOWLEDGEMENT

The authors would like to thank UMMI Surgical Sdn. Bhd. for the free samples of the TIBSIT smell kit, Assistant Professor Ping-Hung Shen for his guidance and consultation and last but not least, the volunteers who had participated in the study.

CONFLICTS OF INTEREST

The original TIBSIT copies in Mandarin and English languages were provided by UMMI Surgical Sdn. Bhd. as free samples for the study. This sponsor source had otherwise no role in the design of this study, its execution, analyses, interpretation of the data, or decision to submit results. The authors have no other conflicts of interest to declare.

REFERENCES

1. Hummel T, Whitcroft KL, Andrews P, Altundag A, Cinghi C, Costanzo RM, et al. Position paper on olfactory dysfunction. *Rhinology* 2016; 56(1):1-30.

2. Doty RL, Shaman P, Kimmelman CP, Dann MS. University of Pennsylvania Smell Identification Test: a rapid quantitative olfactory function test for the clinic. *Laryngoscope* 1984; 94(2 Pt 1): 176-8.
3. Oleszkiewicz A, Schriever VA, Croy I, Hähner A, Hummel T. Updated Sniffin' Sticks normative data based on an extended sample of 9139 subjects. *Eur Arch Otorhinolaryngol* 2019; 276(3): 719-28.
4. Sai-Guan L, Husain S, Zahedi FD, Ahmad N, Gendeh BS. Cultural Adaptation of Sniffin' Sticks Smell Identification Test: The Malaysian Version. *Iran J Otorhinolaryngol* 2020 ; 32 (111): 213-22.
5. Hsu NI, Lai JT, Shen PH. Development of Taiwan Smell Identification Test: a quick office-based smell screening test for Taiwanese. *Am J Rhinol Allergy* 2015; 29(2): e50-4.
6. Meng X, Deng Y, Dai Z, Meng Z. COVID-19 and anosmia: A review based on up-to-date knowledge. *Am J Otolaryngol* 2020; 41(5): 102581
7. Hsieh C-H, Chen PG, Zhou B, Lin L-J, Lai J-T, Shen P-H. Investigation of Normative Value of Commercialized Taiwan Smell Identification Test. *Allergy & Rhinol* 2021. 12: 2152656721991525.
8. Bigman G. Age-related Smell and Taste Impairments and Vitamin D Associations in the U.S. Adults National Health and Nutrition Examination Survey. *Nutrients* 2020; 12(4): 984.
9. Jackman AH, Doty RL. Utility of a three-item smell identification test in detecting olfactory dysfunction. *Laryngoscope* 2005; 115(12): 2209-12.