

ORIGINAL ARTICLE

The development and convergence validity of the Malaysia Smell Test (MAST)

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Abstract:

An olfactory function is important role in our life. The function may decline as people get older. A smell test is a useful tool for predicting the onset of dementia. However, currently, many smell test developed in western country and not culturally appropriate in Malaysia. This study aims to develop and validate the Malaysia Smell Test (MAST) for older person in Malaysia. Besides, it also purposes to identify the relationship between the MAST with SLUMS-BM. A survey among elderly in the community (n=125) was obtained to identify the familiar odours remembered. The MAST kit was developed by using raw materials and 10 commonly odorants were selected. 38 participants from institutions were participated. All the data was analyzed by using SPSS version 21. It was revealed that there is moderate correlation between MAST and SLUMS-BM with (r=0.63) with ICC fair level of agreement (0.43) in which explain (80%) variance in the study. The MAST is easy to administer to the elderly because it's short time, applicable, simple to administer and culturally appropriate in Malaysia as well as appears to recognize high risk of elderly and valuable tool for predicting the onset of dementia.

Keywords: Older people, olfaction, smell identification test

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1. INTRODUCTION

Malaysia will become an ageing country in 2020. The population of elder people will increase from 6.3% in 2000 to 12.0% by 2030 [1]. Old age often associated with cognitive decline and the decline is linked to sensory deficits such as deficit in sense of smell (olfactory), visual and hearings [2]. The sense of smell plays an important role in our life and it's a major sensory perception function which helps people in the detection of taste and hazard signals [3] such as to detect the scent of spoiled food, filthy clothing, and gasoline leaks.

If aging and Alzheimer's disease (AD) are accompanied by a deteriorate in olfactory function, this may lessen the power to sense danger, identify the safety and hygiene of elderly people at risk [4], diminish appetite and quality of life [5]. Losing one's sense smell is a strong indicator of 'significant cognitive damage', and a smell test is a useful tool for predicting the onset of dementia and able to identify high risk elderly. Many test using smell as a tool to detect cognitive deterioration. However, there are no worldwide accepted successful standard smell tests because every country has different familiar of scents to identify [6]. The

odours used in this test may not culturally appropriate to Malaysian culture.

Hence, the aim of the study is to develop and to validate a culturally sensitive smell test known as Malaysian Smell Test (MAST).

2. MATERIALS AND METHODS

Stage 1: The identification of familiar smells among elderly

An interview by used a questionnaire were administering among normal 125 elderly people with aged 60 years and above in the community in several states. They need to list down the odours according to theme (foods or drinks, plants and chemical substances). This method was followed as in the articles: Iran Smell Identification Test (Iran-SIT): a Modified Version of the University of Pennsylvania Smell Identification Test (UPSIT) for Iranian Population [7]. The inclusion criteria include score ≥ 25 in Saint Louis University Mental Status Exam indicates normal people, no depression and at least finished primary school, while the exclusion

criteria are older people aged 60 years and below, having problem related to nose and olfactory such as sinus, impaired vision or hearing and frail and physically dependent elderly such as bedridden.

Stage 2: The development of smell test kit

Prior to the development, literature search was conducted to identify method of development in smell test. Eight studies that develop test on smell were identified.

The Malaysia Smell Test (MAST) was developed according to the survey of published olfactory test. The components that were needed for the test procedure including quantity of items, material of the items, distance from the participant's nose, test duration, and test location.

According to previous study, were selected because of the suitable of components which are time, distance, quantity and materials. The distance of the odours from the nose was placed ~2 cm, a minimum time interval 30s, quantity of the materials is ~20 ml of test solution by using opaque plastic bottles [8-9].

While, the other study [9] was used virtual products and natural etheric oils. From this literature, it was decided to followed their study. This study was used raw materials and put the items in the small container. The containers were put 2cm from the nose with the minimum time interval 30s.

Stage 3: The pilot study

Pilot study was carried out on 18 subjects (15 males and 3 female) at RSK Cheras. This study was done using 16 type of odours that were produced using raw materials (Figure 1). Before conduct the MAST, the explanation of the procedure was given to them. The elderly people were blindfolded when the odours were presented to them to prevent any chance of visual identification.

To conduct the test, the lid of the container was opened for ~3 s, and the mouth of the container was placed in front of the nostril about 2 cm and the elderly people was asked to sniff normally without any force (Figure 2). 30 seconds interval between each sniff were set to prevent olfactory desensitization [8]. After they were smell the odours, they need to answer the questions given by the administrator. The 16 items were tested among elderly from morning to afternoon. The location to administer the MAST are outdoor and indoor area.



Figure 1: The instruments of MAST include containers and blindfold.



Figure 2: The procedure during administration of MAST. The mouth of the container was placed in front of the nostril about 2 cm.

Stage 4: The convergence validity of MAST by using SLUMS

The first step was meet 50 elderly at RSK. The inclusion and exclusion criteria of the study were choosing. The 40 elderly people who fit into the criteria was then assessed the SLUMS-BM and MAST. Those who are decline to participate and not fit into the criteria which is 2 participants were excluded from this study.

The Saint Louis University Mental Status Examination (SLUMS-BM) were administered among them. This assessment is a screening method for Alzheimer's disease and detect early stages of dementia. According to study [10], stated that SLUMS assessment is more sensitive and effectively to identifying dementia compared to others cognitive assessment.

The elderly people were blindfolded when the odours were showed to prevent any chance of identification. During the test, the cap must be remove for ~5s [11]. Then, the mouth of the container was placed about ~2cm in front of their nose. After that, they were asked to sniff normally without any force. The prevention in this test are 30s intervals are set to olfactory desensitization.

The inclusion criteria include older people aged 60 years and above with normal, MNC and dementia, and no depression. Then, the exclusion criteria are older people aged 60 years and below, have problem related to nose and olfactory such as polyps, chronic rhinosinusitis, or allergic rhinitis [11]. hearing and visual impairment were excluded from this study, because hearing and visual impairment were associated with poorer performance on cognitive function tests independent of the other sensory impairments and factors associated with cognition [12], score level 2 and 3 in CDRS and frail and dependent elderly such as older people who are bed ridden.

3. RESULTS

Stage 1: The identification of familiar smells among elderly

There are 193 odours identified by 125 elderly peoples in the community. Then, the 21 odours of high identification are chosen.

In addition, there are several smell which higher number or people identified but there were not selected due to some reasons. The items and reasons for the exclusion are as in table below. Items that are omitted such as *Sambal Tumis* (many type of *sambal tumis*), rose (difficult to find the fresh roses and not culturally appropriate in Malaysian culture), diesel (use petrol as substitute), *Gas dapur* (dangerous odour to smell and difficult to prepare) and perfume (Use soap due to higher number of people identified). Then, the 16 most familiar items with high identification rate are selected in this pilot study (Table 1).

Table 1: 16 most familiar items with high identification rate.

No	Items	Number of people identify	(%)
1	Durian	94	75.20
2	Belacan	91	72.80
3	Kopi	83	66.40
4	Petrol	72	57.60
5	Ikan masin	69	55.20
6	Cempedak	66	52.80
7	Clorox	49	39.20
8	Daun pandan	48	38.40
9	Petai	48	38.40
10	Kari	46	36.80
11	Nangka	45	36.00
12	Sabun mandi	40	32.00
13	Daun kesum	33	26.40
14	Serai	33	26.40
15	Daun limau purut	30	24.00
16	Limau mandarin	22	17.60

Moreover, there are five items which are excluded from the final 16 items as suggested in previous study [9]. There is justification of the exclusion of the items such as *kuini* (not in season), *asap* (could not determine which smoke), *daun kari* (use curry paste as substitute), nescaffe (use coffee as substitute) and *ridsect* (dangerous odour for participant to inhale).

Stage 2: The development of Malaysia Smell Test kit

The test was done by 16 types of raw materials. The materials include *durian*, *belacan*, *kopi*, *petrol*, *ikan kering*, *cempedak*, *clorox*, *petai*, *daun pandan*, *kari*, *belimbing*, *sabun*, *daun kesum*, *serai*, *daun limau purut* and *limau*.

Stage 3: Pilot study

There are 18 participants in Rumah Sri Kenangan were participated in the pilot study. The testing of participating elderly into four educational status groups was as follow: primary, 38.9%, secondary, 33.3%, university, 0%, and not school, 27.8%. The total of participants who were primary school are 7(38.9%), secondary school are 6(33.3%), university is 0(0%) and not school are 5(27.8%).

The result shows that 16 items that are most recognized by the participants. 6 items were excluded because they unable to detect any odours presented and identified it. The two items which are *clorox* and *daun pandan* unable to detect any smells presented by the participants and six items that are *serai*, *daun kesum*, *petrol*, *cempedak* and *petai* were omitted due to the participants answer wrongly as shown in table above. But then, *daun pandan* and *cempedak* were selected due to higher intensity. *Cempedak* was chosen because the item was perceived produce more odours than *nangka*.

Furthermore, 10 items were selected from step 3(item identification) as a final item. The items are *durian*, *belacan*, *kopi*, *kari*, *ikan kering*, *limau mandarin*, *cempedak*, *sabun mandi*, *daun limau purut* and *daun pandan*.

There are several issues of the instrument of Malaysia Smell Test (MAST) encountered during the administration of pilot study. Most of them claimed that the items are too much, 12(66.7%), followed by 9(50%) participants said the odours of items were reduced. The others issue that elderly people mentioned are location administration is not suitable 7(38.9%) and they can see the items inside the container 5(27.8%).

After the analysed the result from this pilot study, the first modification was decreased the raw materials from 16 items to 10 items. Next, the containers were spray by using black paint to avoid the subjects to saw the materials. Besides, the raw materials were changed at least after 3 hours to keep the freshness of materials. Moreover, the location of the test was changed in their room to avoid the smells spread and decreased.

Stage 4: Convergence validity of Malaysia Smell Test by using SLUMS-BM

There are 38 participants in Rumah Sri Kenangan were participated in this study. The respondents were male which are 12(31.6%) followed by female 26(26%).

For the respondent's SLUMS-BM score, the data were split into two group, one is for secondary school and above and the other one is for primary school and below (Table 2) and the result of Malaysia Smell Test (Table 3).

Table 3: The result of Malaysia Smell Test (MAST).

Smell	Smell identification		Intensity				Item identification	
	Yes n(%)	No n(%)	Mild n(%)	Moderate n(%)	Strong n(%)	Very strong n(%)	True n(%)	False n(%)
Durian	38(100)		1(2.6)	7(18.4)	22(57.9)	8(21.1)	24(63.2)	14(36.8)
Belacan	37(97.4)	1(2.6)	1(2.6)	4(10.5)	24(63.2)	8(21.1)	22(57.9)	15(39.5)
Kopi	37(97.4)	1(2.6)	7(18.4)	18(47.4)	12(31.6)		24(63.2)	13(34.2)
Kari	37(97.4)	1(2.6)	1(2.6)	20(52.6)	16(42.1)		15(39.5)	22(57.9)
Ikan kering	38(100)		1(2.6)	15(39.5)	16(42.1)	6(15.8)	22(57.9)	16(42.1)
Limau mandarin	38(100)		8(21.1)	23(60.5)	6(15.8)	1(2.6)	18(47.4)	20(52.6)
Cempedak	38(100)		2(5.3)	13(34.2)	22(57.9)	1(2.6)	16(42.1)	22(57.9)
Sabun mandi	36(94.7)	2(5.3)	12(31.6)	8(21.1)	14(36.8)	2(5.3)	17(44.7)	19(50.0)
Daun limau purut	37(97.4)	1(2.6)	7(18.4)	19(50.0)	10(26.3)	1(2.6)	16(42.1)	21(55.3)
Daun pandan	38(100)		12(31.6)	19(50.0)	79(18.4)		16(42.1)	22(57.9)

Convergence validity between MAST and SLUMS-BM

The result showed that there is medium correlation between MAST and SLUMS-BM with ($r=0.63$) with ICC fair level of agreement (0.43) in which explain (80%) variance in the study. A bivariate Pearson's product moment correlation coefficient (r) was calculated to assess the correlation. The bivariate correlation between these two variables was medium r ($r=0.63$), $p<0.001$.

4. DISCUSSION

From the study, it reveals that there is association of Malaysia Smell Test (MAST) and SLUMS-BM. The decrease total score of SLUMS-BM will causes decreasing total score of MAST. There is medium positive correlation between total score of SLUMS-BM and MAST because of the quality of MAST materials and the quality of environment. Similar result was obtained with a Japanese study stated that by using B-SIT, the participants with Alzheimer's Disease had significantly lower scores of olfactory identification than age-matched elderly participants [13]. A study by Doty et al., [14] mentioned that the olfactory function can be measured more easily than mild cognitive changes and another research by Graves et al., [15] also mentioned that Brief Smell Identification Test (B-SIT) has been found to be a useful and faster test for cognitive impairment assessment.

Moreover, a recent study suggested that age was linked with deficits in odour recognition and identification that may be largely associated to cognitive impairment [16-17]. Other than that, another previous study was conducted [18] stated that there has a strong relationship between sense of smell and cognition among early-onset Alzheimer's disease (EOAD).

However, there are several factors that affect the smell among the participants in this study. A study by [19] stated that the risk factors of smell dysfunction are age, gender, ethnicity or race, educational achievement, family earnings,]

The elderly people will reduce the sense of smell than the adults according to time. Besides, males and females have associated with the factors that affects the smell. Females participants able to identify the odours than the men because they are spending more time in the kitchen every day to cooking as doing housewife task. Every races have difference culture and types of food that they eat. In the market survey, this study was interview by Malay participants to identify familiar odours. The items mentioned are frequently that they used in daily life and culturally appropriate with Malay culture. While during conduct the Malaysia Smell Test (MAST), the most participants are from Malay followed by two Chinese and one Indian elderly people. Thereby, the Chinese and Indian participants may be unable to identify the odours such as *daun pandan* due to unfamiliarity of item.

Besides, the difference lifestyle is associated with the effect of smell. According to the observation, the participants from village or rural area are more likely mentioned the odours from theme of plants and fruits such as *serai*, *kuini*, *daun limau purut*, *daun pandan*, while participants from urban area are mentioned the odours likes perfume and ammonia. It is because the people who live in urban area are usually buy food from outside rather than cooking at home due to busy to gain the income. As a result, they are not familiar with plants' odours.

5. CONCLUSION

The Malaysia Smell Test (MAST) is the first olfactory testing for Malaysian population. The validity appears to be medium correlation when compared with performance on the MAST and SLUMS-BM. There is association between MAST and SLUMS-BM and may be conclude that the cognitive function and the smell test in SLUMS-BM and MAST are linked together. There were some limitations arise that has been identified includes, the number of

Chinese and Indian participants are too little compared to Malay participants and the substances of items are not process into chemical or oil substances. Since, the limited time to manufacturing the substances into chemical, then the raw materials are the best solutions to produce the smell test kit.

Next, the MAST was not conducted to the elderly people in the community. This limitation could not be identifying the result of differences between older people in the institution and the community. Besides, the surrounding is not suitable during conducting the MAST due to noisy and open space as well as there have several factors that affect the smell among participants. Hence, there are a few recommendations for further research. Same variables will be conducted which is a small room with quiet and control humidity and temperature should be prepared to avoid the noisy and the odours spread in the surrounding. In addition, manufacturing process of raw materials into the chemical substances whether in oil solution, microencapsulated or soap to maintain the odours and more long lasting will be focus. Lastly, the interview during the survey should be done to all races as well as the MAST based on races will be conducted in the future research.

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