Impact Assessment of Smell and Taste Disorders on Quality of Life in Thais Using the SF-36 Health Survey (Thai version)

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ABSTRACT

Objective: Smell and taste defects adversely affect both physical and mental health. The Short Form (SF)-36 Health Survey is a widely used tool for the quality of life (QoL) assessment. The aim of this study was to investigate the impact of smell and taste disorders on QoL in Thais using the SF-36 Health Survey (Thai version).

Methods: This retrospective chart review included the patients with smell and taste disorders that attended our clinic during 2011 to 2016. Smell ability was evaluated by phenyl ethyl alcohol odor detection threshold, and smell discrimination and identification tests. Taste ability was evaluated by electrogustometry, regional testing, and modified taste strips. SF-36 was used to assess QoL.

Results: Three hundred fifty-five patients were included in the final analysis. The mean age was 50.8±15.5 years, and 64.2% were female. Most patients (78.59%) had smell disorder only, 15.78% had taste disorder only, and 5.63% had both disorders. Specific to taste disorders, QoL was significantly lower in the patient group than in healthy population for the following 6 domains: physical function, role-physical, bodily pain, general health, vitality, and role-emotional (all $p<0.05$).

Conclusion: The four major causes of smell and taste disorders are nasal/sinonasal diseases, idiopathic causes, post-URI, and head trauma. Women are more often affected than men. Although smell and taste disorders both adversely affect physical and mental health, the taste disorders cause more adverse effect. An assessment tool that is specific to smell and taste disorders may facilitate more detailed elucidation of the effect of these conditions on QoL.

Keywords: Impact assessment; smell and taste disorders; quality of life; QoL; Thai population; SF-36 Health Survey (Thai version) (Siriraj Med J 2019;71: 102-109)

INTRODUCTION

Smell and taste sensations are important neurosensory functions that are known to be closely related. Disorder of one, the other, or both sensations can adversely affect mental health and quality of life[1,2] due to the loss of ability to enjoy food and drink, as well as to enjoy and appreciate pleasant aromas.[3,4] In addition, loss of ability to notice toxic chemicals and gases also affects life safety. Moreover, these disorders have been associated with aging[5] and a broad range of diseases, including Alzheimer's disease and Parkinsonism.[6,7] Causes of olfactory dysfunction include head/surgical trauma, chronic rhinosinusitis, iatrogenic

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causes, viral infection, nasal obstruction, neurologic disorders, medications, endocrine disturbances, and normal aging.[8,9]

However, despite being common symptoms, smell and taste problems are usually underestimated by patients and overlooked by physicians.[10-12] Interestingly, few studies have investigated the effect of olfactory and gustation disorders on quality of life (QoL). Temmel, *et al.*,[13] reported that a high percentage of patients with olfactory disorders complained about daily life problems, such as cooking, eating, detecting their own body odor, and detecting contaminated or spoiled food. A study in 750 patients with abnormal smell or taste perception conducted at the University of Pennsylvania Smell and Taste Center reported that 68% of participants experienced poor QoL, 46% had decreased appetite and body weight, and 56% had worse daily living and psychological well-being.[8] The impact on QoL, including safety issues and interpersonal relations, as well as eating habits and nutritional intake, may be severely altered in a large proportion of patients with olfactory disorders.[13-14] Furthermore, complaints of decreased taste function actually reflect decreased smell function.[8]

The Short Form (SF)-36 Health Survey questionnaire is a widely used tool for the assessment of QoL in various diseases.[15-16] Our review of the literature revealed very few studies that investigated the impact of smell disorder on QoL using the SF-36.[17-19] All 3 of those studies reported a markedly lower QoL in patients with smell problems, especially in the domains of general health (GH) and vitality (VT). The SF-36 was translated into Thai with permission from the original developer in 2000[20], and the SF-36 (Thai version) has since been evaluated several times[21]. To our knowledge, no study has evaluated the effect of smell and taste disorders on QoL in Thai population. Accordingly, the aim of this study was to investigate the impact of smell and taste disorders on QoL in Thai population using the SF-36 Health Survey questionnaire (Thai version 1.0).

MATERIALS AND METHODS

Subjects

This retrospective chart review included patients with smell and taste disorders that attended the Smell and Taste Clinic of the Division of Allergy and Rhinology, Department of Otorhinolaryngology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand during the August 2011 to June 2016 study period. Siriraj Hospital is Thailand's largest national tertiary referral center. The protocol for this study was approved by the Siriraj Institutional Review Board (Si 387/2013).

Patient data were collected, including age, gender, smoking habits, medication history, and possible causes of smell and/or taste disorders. Smell and/or taste tests and ENT examination were then performed. The validated Thai version (version 1.0) of the SF-36 Health Survey was used (with permission) to assess patient QoL.[20] The smell tests included phenyl ethyl alcohol (PEA) odor detection threshold, and smell discrimination and identification tests. The taste tests included electrogustometry (EGM), regional (spatial) testing of taste function, and modified taste strips.

Smell testing

The following 3 smell tests were performed: smell detection, discrimination, and identification. The smell detection threshold test consisted of a forced-choice single-staircase method using PEA, which is a rose-like odorant in different diluents in a concentration series of light mineral oil. PEA has been proven to activate the olfactory nerve, but relatively low activation of the trigeminal nerve.[22] The objective of the smell detection threshold test was to identify the lowest concentration of PEA that the patient could detect.[23,24] The smell discrimination test (SDT) is used to determine a person's ability to distinguish between odorous substances (e.g., coffee) and water, which is an odorless substance.[25] For the smell identification test (SIT), a total of 10 common odorous substances concentrated to suprathreshold concentration levels were selected. The aim of the SIT is to determine a person's ability to correctly identify and name odorants.[25] Since smell identification is strongly affected by culture and eating behavior, the tested odorants must appropriately match the culture and dietary habits of the person being tested.

Taste testing

Electrogustometry (EGM) is a measurement of taste threshold that was performed using a commercially available electrogustometer (Hortmann Neuro-Otometric Myoton, Alberti Technikhandel GmbH, Bad Neuenahr-Ahrweiler, Germany). Regional (spatial) taste function testing was performed using a test developed by the Connecticut Chemosensory Clinic Research Center (CCCRC) (Farmington, New Mexico, USA).[26] The aim of the regional taste function test is to examine taste ability at areas innervated by the greater superficial petrosal branch (right and left soft palate) and the chorda tympani branch (right and left anterior tongue) of cranial nerve VII and cranial nerve IX (right and left posterior tongue). The 4 suprathreshold tastants used for testing included 1.0 mol sodium chloride (NaCl) for salty flavor, 1.0 mol

sucrose for sweet flavor, 0.03 mol citric acid for sour flavor, and 0.001 mol quinine hydrochloride (QHCl) for bitter flavor. Patients were asked not to smoke, brush their teeth, or eat or drink anything other than water for 1 hour before the test. Each tastant was applied to each area of the palate (areas 1-2) and tongue (areas 3, 4, 5, and 6) (Fig 1) with a sterile cotton bud according to a randomized order, for a total of 24 tests (4 tastants x 6 tested areas). The patients had to identify the taste as either salty, sweet, sour, or bitter. If the answer was correct, a score of 1 was given. Patients were also asked to rate the intensity of each tastant on a visual analogue scale (VAS: 0-10), with a higher score indicating a stronger level of taste intensity. After each of the 24 tests, the patient was asked to rinse his/her mouth prior to the next test.

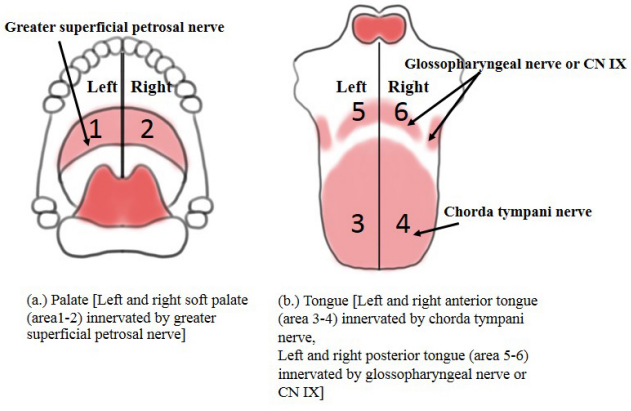

Fig 1. Images showing the palate and tongue areas that are swabbed during regional testing. (Drawing by Miss Boonyisa Pinkaew)

Modified taste strips were applied using a sterile cotton bud (length: 15 cm) with a tip area of 1 cm in length (small size). Each of the 16 cotton buds was impregnated with one of the 4 tastants (salty, sweet, sour, or bitter). Each type of tastant was tested at 4 different concentrations, as follows: *salty* – 1.0, 0.75, 0.50, and 0.25 mol/L sodium chloride; *sweet* – 1.0, 0.75, 0.50, and 0.25 mol/L sucrose; *sour* – 0.03, 0.0225, 0.015, and 0.0075 mol/L citric acid; and, *bitter* – 0.001, 0.00075, 0.0005, and 0.00025 mol/L quinine hydrochloride. These tests were performed at all areas of both the right side and left side of the tongue (Fig 2). The patient had to identify the taste as salty, sweet, sour, or bitter. A correct answer was given a score of 1. The test score ranged from 0 to 16 for each side of the tongue.

Quality of life (QoL) questionnaire

The Thai version (version 1.0) of the SF-36 Health Survey is a 36-item patient-reported survey of health that consists of scaled scores for the following 8 domains:

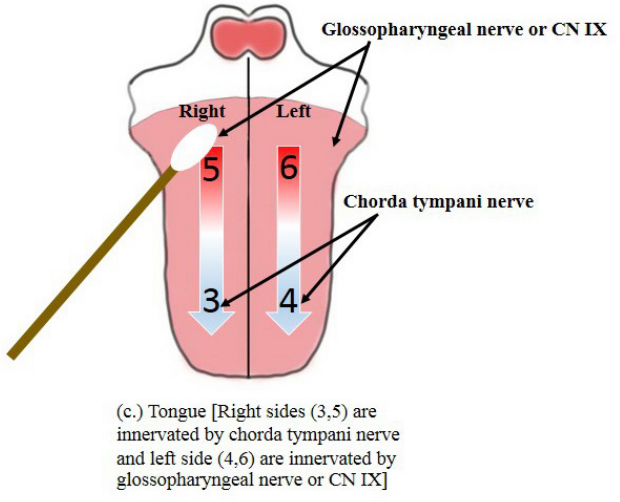

Fig 2. Image showing the areas of the tongue that are swabbed during modified taste strip testing. (Drawing by Miss Boonyisa Pinkaew)

physical functioning (PF); role-physical (RP); bodily pain (BP); general health (GH), which measures physical health; vitality (VT); social functioning (SF); role-emotional (RE); and, mental health (MH), which measures mental health. The SF-36 (Thai version) was adapted from English, and was shown to have proven validity and reliability. [20-21] Raw scores are transformed to scores ranging from 0 to 100, with higher scores indicating better health status.

Data analysis

All statistical analyses were performed using SPSS Statistics version 18.0 (SPSS, Inc., Chicago, IL, USA). Descriptive statistics were used to summarize participant demographic and lifestyle characteristics, and the causes of smell and/or taste disorders. Data are reported as percentage, number and percentage, or mean ± standard deviation (SD). Normally distributed continuous data were evaluated by One-Sample Kolmogorov-Smirnov Test, and are reported as mean ± SD. Demographic data, including age and duration of disorder, were compared between groups using one-way analysis of variance (ANOVA). The number of cases was compared between groups using Pearson's chi-square test. QoL scores were analyzed using Kruskal-Wallis test for non-normally distributed data (PF, RP, BP, VT, SF, RE, and MH), and by ANOVA for normally distributed data (GH). A *p*-value less than 0.05 was considered statistically significant for all tests.

RESULTS

Of 372 patients with complaints of smell and/or taste disorders who were seen at our clinic during the study period, 17 (4.57%) patients were excluded for

having either incomplete data or normal smell and/or taste test result. The remaining 355 patients were enrolled and included in the final analysis. We categorized three groups of disorders for further evaluation smell only, taste only and combined smell and taste disorder determined by phenyl ethyl alcohol (PEA) detection threshold, smell discrimination and identification tests and taste ability including electrogustometry (EGM), regional (spatial) testing of taste function and modified taste strips. Two hundred and seventy-nine patients (78.6%) had problems with smell only (mean age: 49.9 ±16.0 years, range: 8-87; 102 males and 177 females), 56 patients (15.8%) had problems with taste only (mean age: 56.5±13.9 years, range: 15-81; 16 males and 40 females), and 20 patients (5.6%) had problems with both smell and taste (mean age: 48.7±12.1, range: 30-68; 5 males and 15 females). Demographic characteristics, and causes of smell and/or taste disorders are shown in Table 1. More women had smell and/or taste problems than men (64.2% vs. 35.8%, respectively). Almost all patients (82.3%) were non-smokers, with 9.6% being ex-smokers and 8.2% being current smokers. The diagnosed cause of smell and/or taste disorders was nasal/sinonasal diseases (SND; 50.7%), unknown (idiopathic) cause (21.7%), post-URI (10.1%), head/surgical trauma (10.1%), chemical exposure (1.7%), and other causes (5.6%).

SF-36 (Thai version) scoring compared among Thai patients with smell and/or taste disorders and healthy Thai population is shown in Table 2. There was no significant difference among the smell only, taste only, and smell and taste disorder groups, except for the Physical function (PF) dimension (p=0.013), and the significant difference was between the smell only and the smell and taste defect groups. A significant difference was found between smell only and taste only, and also between both smell and taste and taste only. However, patients with taste disorders tended to have poorer QoL among the 3 groups followed by patients with smell disorders and patients with smell and taste disorders, respectively. Nevertheless, in comparison between each group of this study and the data of a healthy population[21], QoL was significantly lower in the domain of general health (GH) which evaluates overall health, including current health, health outlook and resistance to illness in all groups. In addition, there was also significantly lower score in some domains especially, vitality (VT) which evaluates feeling energetic and full of pep versus feeling tired and worn out (Table 2).

TABLE 1. Demographic characteristics, and causes of smell and/or taste disorders.

Characteristics	Smell disorder (N=279)	Taste disorder (N=56)	Smell and taste disorders (N=20)	All groups (N=355)
Age (yr), (mean±SD)	49.9±16.0	56.5±13.9	48.7±12.1	50.8±15.5
Age range (yr)	8-87	15-81	30-68	8-87
Gender, n (%)				
Male	102 (36.6%)	16 (28.6%)	5 (25.0%)	127 (35.8%)
Female	177 (36.4%)	40 (71.4%)	15 (75.0%)	228 (64.2%)
Smoking status, n (%)				
Never smoked	228 (81.7%)	48 (85.7%)	16 (80.0%)	292 (82.3%)
Current smoker	23 (8.2%)	5 (8.9%)	1 (5.0%)	29 (8.2%)
Stopped smoking	28 (10.0%)	3 (5.4%)	3 (15.0%)	34 (9.6%)
Duration of disorder (mo), (mean±SD)	34.7±54.4	17.9±34.5	19.7±24.7	33.2±52.6
Causes, n (%)				
Nasal/sinonasal diseases	162 (58.1%)	8 (14.3%)	10 (50.0%)	180 (50.7%)
Post-URI	34 (12.2%)	2 (3.6%)	0 (0.0%)	36 (10.1%)
Head/surgical trauma	33 (11.8%)	0 (0.0%)	3 (15.0%)	36 (10.1%)
Chemical exposure	5 (1.8%)	0 (0.0%)	1 (5.0%)	6 (1.7%)
Idiopathic causes	34 (12.2%)	37 (66.1%)	6 (30.0%)	77 (21.7%)
Others	11 (3.9%)	9 (16.1%)	0 (0.0%)	20 (5.6%)

TABLE 2. SF-36 score compared among Thai patients with smell and/or taste disorders and healthy Thai population.

SF-36 scores	Smell disorder (mean±SD) (N=279)	Taste disorder (mean±SD) (N=56)	Smell and taste disorders (mean±SD) (N=20)	Healthy population (mean±SD) (N=1,345)[21]
Physical function (PF)	75.53±20.17	67.23±21.55#	77.50±17.43	77.50±17.40
Role-physical (RP)	71.14±38.94*	63.84±43.93#	72.50±37.96	82.20±28.50
Bodily pain (BP)	68.85±19.56*	66.27±19.23#	69.75±21.79	74.90±18.20
General health (GH)	50.37±16.35*	44.93±19.50#	50.05±15.99*#	65.20±17.40
Vitality (VT)	57.75±16.38*	51.88±19.44#	58.50±13.48	61.80±13.50
Social functioning (SF)	72.76±22.88*	73.88±21.22	71.88±15.64	78.30±18.50
Role-emotional (RE)	64.16±42.29*	60.12±44.69#	81.67±35.00	80.20±31.80
Mental health (MH)	65.02±18.04	62.64±20.36	67.60±14.90	65.50±13.00

A P-value<0.05 indicates statistical significance

**Statistically significant by unpaired t-test between smell disorder and healthy Thai population*

#Statistically significant by unpaired t-test between taste disorder and healthy Thai population

**#Statistically significant by unpaired t-test between smell and taste disorders and healthy Thai population.*

DISCUSSION

Few studies have investigated the impact of smell and/or taste impairment on QoL. Moreover, the study of smell and taste disorders in Thai patients are rather new and rare. We are able to report the results from a large study population because our clinic is the first Smell and Taste Clinic to be established in Thailand. Clinical investigations have shown poor general QoL, depression and mood changes, and difficulties in daily life in this patient population. This is the first investigation of QoL impairment due to smell and/or taste disorders in Thai patients using the SF-36 Health Survey (Thai version).

Our findings revealed the most common etiologies to be nasal/sinonasal diseases (SND) (50.7%), idiopathic cause (21.7%), post-URI (10.1%), head/surgical trauma (10.1%), chemical exposure (1.7%), and other causes (5.6%), including aging, diabetes, hypertension, genetic disorders (Kallmann syndrome), Parkinsonism, and other neurologic disorders. These results are similar to those reported from other studies (Table 3). Kaolawanich, *et al.*,[27] reported possible causes of smell disorder in a clinical population of Thais to be SND (66.7%), head injury (12.1%), idiopathic cause (10.6%), post-viral upper respiratory infection (URI) (6.8%), congenital cause (3%), and other (0.8%). Damm, *et al.*, found inflammatory diseases of the nose/paranasal sinus (53%), postviral conditions (11%), idiopathic causes (6%), head trauma (5%), chemical exposure (2%), and other (23%) to be the most common causes of smell defect.[28] Miwa, *et al.*,[4] reported different proportions of the same causes reported by Damm, *et al.* Nordin and Bramerson[29] reported the most common etiologies of smell loss to be URI (18-45% of the clinical population) and nasal/sinus disease (7-56%), followed by head trauma (8-20%), exposure to toxins/drugs (2-6%), and congenital anosmia (0-4%). Amongst the range of etiologies that have been reported from numerous studies[8,13], the most commonly reported cause of smell disorders was URI, followed by idiopathic cause and head injury. These variations in reported incidences among etiologies may be due to differences in race, environment, socioeconomic status, lifestyle, and culture- all of which may play an important role in smell and taste disorders.[27] As a result, the causes reported from various studies are very similar, with differences only in the proportions of patients affected within each study.

The data from this study revealed taste disorders as having the most impact on QoL in all domains of the SF-36 Health Survey (Thai version). Significantly lower scores were found in 6 domains when compared to healthy population, including physical function (p<0.0001), role-physical (p<0.0001), bodily pain (p=0.0005), general health (p<0.0001), vitality (p<0.0001), and role-emotional (p<0.0001). Smell only and combined smell and taste

TABLE 3. Etiology of olfactory disorders from this study and prior studies.

Etiology	Pinkaew, *et al.*(2019) %	Miwa, *et al.* (2011) %	Kaolawanich, *et al.* (2009) %	Damm, *et al.* (2004) %
Nasal/sinonasal diseases	50.7%	21.4%	66.7%	53.0%
Idiopathic causes	21.7%	28.4%	10.6%	6.0%
Post-URI	10.1%	17.1%	6.8%	11.0%
Head/surgical trauma	10.1%	17.1%	12.1%	5.0%
Chemical exposure	1.7%	3.2%	0.0%	2.0%
Other causes	5.6%	11.6%	3.8%	23.0%

Abbreviation: URI =upper respiratory infection

disorders resulted in a higher score. This may be due to the Thai cultural habit of consuming hot and spicy food. Trachootham, *et al.*,[30] reported that Thai people have a strong preference for spicy food, with a preference for mild-moderate spicy food in 70%, and very spicy food in 10% of respondents. That study also found that 70% of Thai people consumed spicy food on a weekly basis. These findings suggest that populations with a preference for hot and spicy foods, such as Thailand, may have much poorer taste sensitivity and perception.[30] Another reason that SF-36 (Thai version) scores were significantly lower in patients with taste defect may be due to the small number of patients in the taste disorder group. Future study in a larger study population is, therefore, recommended-especially since problems with taste were found to have the most adverse effect on QoL.

In groups of taste only and combined, higher scores were observed. This was striking, but could also a bias due to the small-sized number of patients in both groups.

Moreover, in a comparison among the 3 study groups, the lowest scores were observed in the General health (GH) and Vitality (VT) domains. Additionally, when compared with 2019 data from healthy Thai population[21], the scores were significantly lower in all domains and in all groups. Prior studies in the impact of smell disorders on QoL using the SF-36 Health Survey are shown in Table 4 and Fig 3. These studies show a similar pattern in each domain. Consistent with the findings of the present study, the lowest scores were found in the General health (GH) and Vitality (VT) domains.[17-19] The GH domain assesses QoL relative to general physical health, and the VT domain assesses QoL relative to the patient's level of feeling drowsy or sedated.[16] Interestingly, the findings of the present study are lower than those reported in all previous reports[17-19], which may signify the impact of differences in race, behavior, culture, environment, socioeconomic status, and lifestyle among different cultures.

This study has some mentionable limitations. First and consistent with the retrospective nature of this study, some patient data may have been missing or incomplete. Second, the size of two of our three study groups was relatively small. As a result, our study may have lacked sufficient power to identify all significant differences and associations. Third, the patients enrolled in this study were from a single center, which is located within a large urban metropolis. Fourth, our center is Thailand's largest tertiary referral hospital, which means that we are often referred patients with complicated and intransigent conditions. As such, it is possible that our findings may not be generalizable to patients with the same condition in other settings. Importantly, the strength of this study is that this data is representative of treatment outcomes in a real-world setting from the first Smell and Taste Clinic to be established in Thailand.

CONCLUSION

The present study revealed that Thai women suffer from smell and taste disorders more than Thai men. The four major causes of smell and taste disorders are nasal/sinonasal diseases (50.7%), idiopathic causes (21.7%), post-URI (10.1%), and head trauma (10.1%). Smell and taste disorders adversely affect both physical and mental health, with taste disorders adversely effectuating more causation than smell disorders. Although the SF-36 is the most widely used assessment for evaluating QoL, a questionnaire that is specific to smell and taste disorders may facilitate more detailed elucidation of the effect of these conditions on QoL.

TABLE 4. Mean SF-36 scores by domain in patients with smell disorders from this study and prior studies.

SF-36 scores	Pinkaew, *et al.* (2019) (mean±SD) (N=279)	Katotomichelakis, *et al.* (2013)[17] (mean±SD) (N=89)	Neuland, *et al.* (2011)[18] (mean±SD) (N=280)	Seems, *et al.* (2009)[19] (mean±SD) (N>82)
Physical function (PF)	75.53±20.17	80.00±19.42	71.53±27.50	81.44±22.78
Role-physical (RP)	71.14±38.94	69.66±28.52	56.52±42.77	75.00±37.55
Bodily pain (BP)	68.85±19.56	87.67±16.54	61.51±30.31	84.38±20.63
General health (GH)	50.37±16.35	60.07±19.43	52.73±20.08	66.44±20.73
Vitality (VT)	57.75±16.38	68.09±21.88	52.43±20.69	64.43±17.74
Social functioning (SF)	72.76±22.88	83.57±18.42	74.07±25.72	91.52±21.44
Role-emotional (RE)	64.16±42.29	74.53±28.34	63.10±42.84	84.67±29.99
Mental health (MH)	65.02±18.04	68.40±19.46	66.36±19.77	73.24±16.13

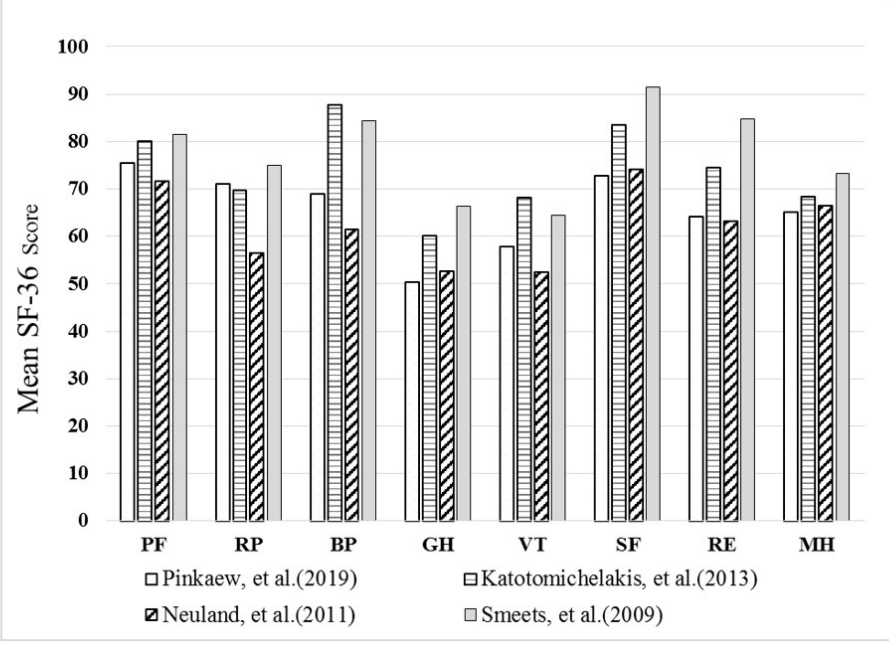

Fig 3. Comparison of the mean SF36 scores for each domain among 4 studies.

Physical function domain (PF)	Role-physical domain (RP)
Bodily pain domain (BP)	General health domain (GH)
Vitality domain (VT)	Social functioning domain (SF)
Role-emotional domain (RE)	Mental health domain (MH)

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