行政院國家科學委員會專題研究計畫 期末報告

不同性別與性別角色在實驗性疼痛與心理因素之關連性-性別影響評估研究（GM01）

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執 行 單 位 ：高雄醫學大學物理治療學系

計 畫 主 持 人：呂怡靜
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公 開 資 訊 ：本計畫涉及專利或其他智慧財產權，2 年後可公開查詢

中 華 民 國 102 年 10 月 28 日

中文摘要：性別主流化工作是國際間共同積極努力的方向，在醫護體系中的治療、照護行為都必需以不同性別特性作妥善考量，才能提出有效的改善策略。本計畫研究「不同性別與性別角色在實驗性疼痛與心理因素之關連性-性別影響評估研究」。

方法：以客觀溫度感覺量化測試（Quantitative sensory test, QST），瞭解不同性別的差異、性別角色的差異，以及性別差異受性別角色與其他心理因素影響的狀況。研究將分為兩部分進行，第一部分研究溫度感覺量化測試信度。第二部分研究年齡、性別、性別角色、各種心理因素於各種溫度感覺量化測試差異與影響效果。溫度感覺量化測試分別為冷溫度閾值(Cold detect threshold, CDT)、熱溫度閾值(Warm detect threshold, WDT)、冷痛覺閾值(Cold pain threshold, CPT)與熱痛覺閾值(Heat pain threshold, HPT)及冷痛覺忍受值(Cold pain tolerance, CPTol)與熱痛覺忍受值(Heat pain tolerence, HPTol)。性別角色評估方面以性別角色量表評估，心理因素評估方面將包括因應方式、焦慮、憂鬱、人格特質、健康生活品質與幸福感評估。

結果：第一部分研究溫度感覺量化測試信度。QST 測量方式包括極限法(method of limit) 及層級法(method of level)，兩者都具有很高的再測信度。以極限法及層級法(method of level)比較，相對信度(relative reliability)兩者相近，而絕對信度(absolute reliability) 極限法優於層級法。從資料分佈型式，CDT 與 WDT 受試者間差異小，CPT、HPT、CPTol 與 HPTol 受試者間差異大，尤其是 CPT。第二部分研究年齡、性別、性別角色、各種心理因素於各種溫度感覺量化測試差異與影響效果。年齡與性別都是 QST 重要影響因素，其中 CDT 和 CPT 最受年齡左右、WDT 和 HPT 是受性別左右、而 CPTol 與 HPTol 同時受性別、性別角色與各種心理因素所影響。

本研究結果將可建立國內不同性別，年齡階段之實驗性疼痛重要數據，瞭解正常受試者影響實驗性疼痛重要因素先後順序，可提供未來研究疼痛與治療策略的重要依據。

中文關鍵詞：疼痛、感覺量化測試、性別、性別角色、影響因素

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of gender on assessment'. Gender analysis is an important gender mainstreaming skill. In this project, pain is the most common health problem of the world has been investigated with emphasis on the gender difference, to find the consequences of gender inequality with respect to health differences, such as the differences of the risk factors and vulnerability. The pattern of pain has also been studied by exploring the influenced factors. Therefore, to analyses the pain perception and influence factors in difference sex and different gender role is worthwhile.

Methods: The changing of temperature and pain perception were tested by thermal quantitative sensory testing (QST), the data including the cold and warmth detection threshold (CDT and WDT), cold and heat pain threshold (CPT and HPT) and cold and heat pain tolerance (CPTol and HPTol). Two parts of the study design included in the project. First part was to assess the reliability of the QSTs. Second part was to exam the difference of sex, gender role in QSTs. Considering the possible factors influence the pain, sex and gender, a set of inventory for psychological tests will also be performed, including assessment of anxiety, depression, personality, health related quality of life and well being.

Results: For first part of study, the test-retest reliability for the method of limit and the method of level were good and excellent. Comparing the method of limit and the level, the method of limit was better absolute reliabilities than the method of level. The variation between subjects was small for the CDT and WDT, but was large for the CPT, HPT, CPTol and HPTol. For second part of study, the CDT and CPT were significantly predicted by age. However, the WDT and HPT were significantly predicted by sex. The gender role characteristics and multi-psychological factors also influenced the CPTol and HPTol.

We recommend using the method of limit to assess the QSTs, due to better absolute reliability and easy test for clinical application. The results clarify the important role of age, gender, and psychological factors in different types of QST. The results of this study should provide useful suggestions in clinical practice about pain assessment and treatment.

英文關鍵詞： pain, quantitative sensory test, sex, gender role, factor

行政院國家科學委員會補助專題研究計畫 □期中進度報告 ■期末報告

不同性別與性別角色在實驗性疼痛與心理因素之關連性

-性別影響評估研究

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計畫主持人：呂怡靜
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計畫參與人員：蒲怡妤、施昱丞、劉雅棻

成果報告類型(依經費核定清單規定繳交)：□精簡報告　■完整報告

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□出席國際學術會議心得報告
□國際合作研究計畫國外研究報告
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□涉及專利或其他智慧財產權，□一年■二年後可公開查詢

中　華　民　國　102 年　10 月 28 日

一、 目 錄

中文摘要

性別主流化工作是國際間共同積極努力的方向，在醫護體系中的治療、照護行為都必需以不同性別特性作妥善考量，才能提出有效的改善策略。本計畫研究「不同性別與性別角色在實驗性疼痛與心理因素之關連性-性別影響評估研究」。

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本研究結果將可建立國內不同性別，年齡階段之實驗性疼痛重要數據，瞭解正常受試者影響實驗性疼痛重要因素先後順序，可提供未來研究疼痛與治療策略的重要依據。

關鍵詞：疼痛、感覺量化測試、性別、性別角色、影響因素

Abstract

The title of this project is “Sex differences and gender-role differences in the relationship between experimental pain and psychological factors: Impact of gender on assessment”. Gender analysis is an important gender mainstreaming skill. In this project, pain is the most common health problem of the world has been investigated with emphasis on the gender difference, to find the consequences of gender inequality with respect to health differences, such as the differences of the risk factors and vulnerability. The pattern of pain has also been studied by exploring the influenced factors. Therefore, to analyses the pain perception and influence factors in difference sex and different gender role is worthwhile.

Methods: The changing of temperature and pain perception were tested by thermal quantitative sensory testing (QST), the data including the cold and warmth detection threshold (CDT and WDT), cold and heat pain threshold (CPT and HPT) and cold and heat pain tolerance (CPTol and HPTol). Two parts of the study design included in the project. First part was to assess the reliability of the QSTs. Second part was to exam the difference of sex, gender role in QSTs. Considering the possible factors influence the pain, sex and gender, a set of inventory for psychological tests will also be performed, including assessment of anxiety, depression, personality, health related quality of life and well being.

Results: For first part of study, the test-retest reliability for the method of limit and the method of level were good and excellent. Comparing the method of limit and the level, the method of limit was better absolute reliabilities than the method of level. The variation between subjects was small for the CDT and WDT, but was large for the CPT, HPT, CPTol and HPTol. For second part of study, the CDT and CPT were significantly predicted by age. However, the WDT and HPT were significantly predicted by sex. The gender role characteristics and multi-psychological factors also influenced the CPTol and HPTol.

We recommend using the method of limit to assess the QSTs, due to better absolute reliability and easy test for clinical application. The results clarify the important role of age, gender, and psychological factors in different types of QST. The results of this study should provide useful suggestions in clinical practice about pain assessment and treatment.

Key words: pain, quantitative sensory test, sex, gender role, factor

Introduction and literature review

Quantitative sensory testing (QST) has become a common tool to assess the sensory status by increasing or decreasing the temperature [1]. Conventional nerve conduction velocity test cannot assess the magnitude of sensory deficits or quantification of thermal allodynia and hyperalgesia, thermal quantitative sensory testing (tQST) thus can provide precise quantification of thermal intensity and be able to assess thermal sensory threshold and thermal pain threshold [1]. Different thermal stimuli are used for assessing different sensory responses corresponding different types of peripheral nerve fiber. Cold sensation is sensitized by Aδ fiber, warm sensation is sensitized C fiber, and thermal pain sensation is sensitized by Aδ and C fiber both [2]. Previous studies found the thermal thresholds were influenced by the age, the absolute threshold increased with age [3], and the absolute thermal pain thresholds were also increased with age [4]. However, the studies for sex aspect in QST is insufficient. Gender mainstreaming is an important concept for health, education, environment and policy [5-9]. The World Health Organization (WHO) recommends that the researches should consider the difference between male and female, and also consider the socialization gender (gender role characteristics) difference. Gender role refers to the behavioral norms that are accepted and expected for a man/woman in a specific social culture [9-11]. The masculinity and femininity characteristics for a man/woman may influence the responses testing by QST. Therefore, beside the sex different, gender role characteristic may also need to design to explore the influence for pain assessment.

Previous methods and results of QST were inconsistent. Concerning different algorithms for the assessment of sensory thresholds, two most commonly used algorithms are the method of limits and the method of level. Yalnisky et al. [12] thought that the method of level emerged advantage than the method of limit. However, other studies did not suppose this perspective [13]. Several studies used the poor statistic methods to assess the reliability [14-15]. According to Quality Assessment of Diagnostic Accuracy Studies (QUADAS), a measure of reliability such as ICC is more appropriate statistical analysis [14]. Furthermore, several statistical methods and indices are suggested to fully examine the reliability of outcome measures; both relative and absolute reliabilities should be assessed [16-18]. Relative reliability refers to the ability of a measure to distinguish between people. The intraclass correlation coefficient (ICC) has become a most popular statistical method in relative reliability studies. Nevertheless, ICC can provide only limited information about measurement error [19] . A high ICC does not necessarily imply small measurement error. However, the absolute reliability, such as the standard error of measurement (SEM), and the smallest real differences (SRD) should be investigated to determine the extent of measurement error [20-21]. For clinical application, an actual scale of measurement is an important advantage for clinical interpretation. For assessing relative and absolute reliability, more reliable estimation of tQST is necessary.

Psychological factors might be closely related to pain behavior [22]. Persons with chronic pain feel depression, anxiety, frustration, anger or fear, beliefs that are more negative, and negative emotion. Personality also appears to exert a large influence on emotion and illness behavior in pain processing [23-28]. The impact of pain problems on life not only concerned the physical component but also the mental component. A survey study for the multipurpose health relative quality of life (HRQOL) found that both the physical component summary (PCS) and mental component summary (MCS) measured by Short-Form 36 (SF-36) were lower in patients with chronic neck pain (CNP) than relative norms [29].

Purpose of study

Two purpose of this project.

First: to investigate the reliability of the QST for pain assessment

Second: to explored the influence factors of QSTs, such as age, sex, gender role characteristics, and psychological factors.

Methods

Subjects

Health subjects without neurological disease, systemic disease and upper limb injury were included in this study. In part I study, 28 college students (14 female, 14 male) was included for reliability study. All subjects had no palmer or forearm injury within one month. In part II study, 218 participants (114 female, 104 male) were included for age, gender, gender role and psychological factors analysis. The study was approved by Institutional Review Board of Kaohsiung Medical University Chung-Ho memorial hospital, and written informed consent was written by all subjects.

Procedures and instruments

After explanation the research program, the subjects were in a quiet room and the room temperature controlled at 22~24°C for all assessment. Subjects first was received the QST analysis, and rest 3-5 min then completed a set of questionnaire. (gender role assessment and psychological tests). The subjects included in reliability study were re-tested after one week, and the same procedure was repeated.

1. QST analysis

A single practiced technician performed all tests. During the experiment, the subjects were not able to see variation of temperature on computer screen. Subjects would first rest for 15 min and then practice all the sessions one time on their right medial forearm, assuring that they had already known the method of measurement and be able to react correctly. After practicing and rest 1-2 min, the length of subjects' left arm was measured and the 30 x 30mm Peltier type thermode (TSA-2001,Medoc Inc., Israel) was put on the middle of subjects' left medial arm. The baseline temperature was 32°C, and the ramped temperature was 1 °C /s. Cut-off temperatures were 0 and 50 °C[30].

The QST analysis included the following tests: the cold and warmth detection threshold (CDT and WDT), cold and heat pain threshold (CPT and HPT) and cold and heat pain tolerance (CPTol and HPTol). To verify the precise of different measuring methods, both the method of limit and method of level were used. The CDT, WDT,CPT and HPT were measured by both method of limit and method of level. The CPTol and HPTol which subjects were asked to endure pain stimuli until hardly to endure were measured by method of limit only.

For method of limit, the intensity of stimuli was increased until that subjects perceived specific thermal or pain sensation and pressed a button with their right hand. The instruction of thermal detection threshold (CDT&WDT) was "Once you feel cold/warm, press the button." The instruction for thermal pain threshold (CPT&HPT) was "When you feel cold/warm to the place that you feel a little bit uncomfortable, press the button." The instruction for thermal pain tolerance (CPTol & HPTol) was "When you feel cold/warm to the place that you feel hardly to endure, press the button."

For method of level, an initial temperature step of 4°C was set, while the temperature returned to 32°C immediately after termination of each trial [31]. Subjects were asked to answer YES or NO response depending on whether or not perceived specific thermal or pain sensation. A YES response leaded to following smaller stimulus, while a NO response caused a larger subsequent stimulus. Magnitude of change was determined by the previous trials – step magnitude being halved as turns of direction, or unchanged for no alteration in direction. Thus, if a specific trial had a similar response to the previous one (NO-NO or YES-YES), step magnitude for the following trial was unchanged, while for a different response (NO-YES or YES-NO), the next step was halved. The trials were continued until step magnitude reached 0.2°C. Threshold of thermal or pain sensation was the average of stimulus temperature for the last YES trial and the last NO trial.

Subjects formally accepted trial below consecutively– CDT and WDT sessions for 4 trials each by method of limit; CPT and HPT sessions for 3 trials each by method of limit; CDT and WDT sessions in method of level; CPT and HPT sessions in method of level; and finally CPTol and HPTol sessions for 3 trials each. During the experiment, adequate rest was given between each session, and the mean threshold of trials in a session was calculated.

After each trial for pain threshold or tolerance, Visual Analogue Scale (VAS) was used for measuring subjective pain perception and endurance.(2) VAS is a 10 cm horizontal line present “no pain” at the end point of left side and ”severe pain” at the end point of opposite side. Subjects were asked to mark a point on the line that reflected to the magnitude of their current pain in their left medial forearm.

2. The Bem Sex Role Inventory (BSRI)

After the QST assessment, the gender role characteristic was assessed by BSRI. The BSRI measured the masculinity (masculinity scales, MS) and the femininity (femininity scales, FS). The type of gender role orientation (masculinity, femininity, androgyny, and undifferentiated) was classified by the amount of FS and MS. The score of both MS and FS≧4.9 is classified as androgyny orientation, only MS score≧4.9 as masculinity , FS score≧4.9 as femininity, both below 4.9 as undifferentiated orientation [32].

3. Psychological tests

After assess the BSRI, a set of inventory for psychological tests will also be performed, including assessment of anxiety, depression, personality, coping, health relative quality of life and well being.

The Beck Anxiety Inventory (BAI) is a 21-item scale for self-report questionnaire measuring symptoms of anxiety [33]

The Beck Depression Inventory (BAI) is a 21-item scale for self-report questionnaire measuring symptoms of Depression [34].

The Chinese brief version of Eysenck Personality Questionnaire (EPQ) was performed for measuring personality characteristics [35]. The brief EPQ measures two types of personality, the neuroticism (EPQ-N) and extraversion (EPQ-E). The EPQ brief version has good internal consistency, test-retest reliability, and concurrent validity [36].

Coping Strategies Questionnaire (CSQ) was performed for measuring coping strategies [37].The CSQ assess 6 factors of the coping strategies, including the distraction, catastrophizing, ignoring pain, distancing from the pain, coping self-statements, and praying. The 6 sub-scores of CSQ can be classified two domain: positive coping strategy and negative coping strategy.

The Subjective Well Being (SWB) was tested by Chinese Happiness Inventory (CHI) to measure perceived level of happiness. The CHI has 10 items, the score of the responses of each item was from 0 to 3, the higher score indicating the better SWB [38-39].

The SF-36 measures 8 health attributes: physical functioning (PF), role limitations due to physical health problems (Role-physical, RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role limitation due to emotional problems (Role-emotional, RE) and mental health (MH). The two summary measures, physical component summary (PCS) and mental component summary (MCS) were calculated from these 8 subscales to demonstrate the overall physical and mental function respectively [40]. The SF-36 of Taiwan version illustrated good reliability and validity [41-42].

Statistical Analysis

Part I study:

The Student's *t* test was used to assess the difference between male and female. Intraclass correlation coefficients (ICCs) were used to estimate relative reliability. The ICC was calculated as the ratio for the variance between subjects and the total variance. According to a report by Fleiss, values of ICC$\geqq$0.75 show excellent reliability [43]. Absolute reliability was established by a series of statistical procedures.

The standard error of measurement (SEM) and the smallest real difference (SRD) were used to estimate absolute reliability. Measurement errors were evaluated by the SEM. The SEM was calculated by using the formula (standard deviation (SD) of all inter-rater strength) x $\sqrt{(1\text{-}ICC_{two\ raters})}$. SRD was calculated as 1.96 x SEM x$\sqrt{2}$, indicating the change score of an individual subject is real at the 95% confidence level. A good measurement tool should have low SEM and SRD values to be used to detect changes in the clinical trial [44-46].

Systematic bias was assessed with the Bland and Altman analyses [47]. The Bland and Altman plot provides visual interpretation, in which the difference between raters A and B (A minus B) is plotted against the mean of the strength by the two raters for each subject. The plot of difference against the mean allows researchers to investigate any possible relationship between the measurement error and the true value. The 95% limits of agreement (LOA) were shown in plot (mean difference ± 1.96 SD of the difference).

Furthermore, paired *t*-tests were also used to examine the systematic bias from rater A to rater B. It is also important to observe whether there is any heteroscedasticity in the data; it indicate the strength differences between raters depend on the magnitude of the strength mean. The Pearson's correlation coefficient of the absolute differences of rater A and rater B and the mean of the two raters was performed to assess the heteroscedasticity.

Part II study

For better description the degree of temperature change for QST data, the following data was shown as raw data minus 32. The QST data were test the normal distribution first then for further analysis. Logistic transformation of the QST data was performed when the data was not normal distribution. The Student's *t* test was used to assess the difference between male and female. The analysis of variance (ANOVA) was used to assess the difference of four gender role orientations. To explore the QSTs be influenced by different factors, the linear regression with stepwise method was applied to assess the variables such as age, gender, height, body weight, MS and FS, active and passive coping score, BAI and BDI, EPQ-N and EPQ-E, PCS and MCS, and SWB. The absolute CDT, CPT and CPTol were used as dependent variables for linear regression analysis. The α level was set at 0.05. All statistical analyses were done with SPSS18.0 for Windows.

Results

Part I: Reliability study

Twenty-eight subjects (14 males and 14 females) were recruited in this study. Figure 1 demonstrates the mean temperature of each trial by methods of limit. Table 1 shows the values of CDT, WDT, CPT, HPT, CPTol and HPTo by methods of limit and methods of level (denote as LCDT, LWDT, LCPT and LHPT), and also shows the VAS values at the temperature of CPT, HPT, CPTol and HPTo of the first test. Most of the QSTs were difference between men and women, however, all the VAS values did not show significant difference.

Intra-test reliability

The ICCs (1, 1) for 5 kinds of threshold (except WDT) measuring by method of limit were all higher than 0.83, indicating excellent intra-test reliability (Table 2). The value of ICC for WDT was 0.69, indicating the intra-test reliability was good.

Test-retest reliability

For relative reliability, the ICCs for pain thresholds or tolerances in method of limit or method of level were all higher than 0.75, indicating excellent reliability (Table 2). The ICCs of CDT and LCDT were also higher than 0.75, indicating excellent reliability. However, the ICCs of WDT and LWDT were higher than 0.60, indicating the reliability was good.

For absolute reliability, the value of SEM for CDT and WDT were very small only 0.38, and the value of SRD were only 1.05 and 1.06 respectively. The value of SEM for CPT was larger than HPT, and CPTol was also greater than HPT The value of SEM of LCDT, LWDT and LHPT was larger than CDT, WDL and HPT respectively. (Table 2).

The results of Bland and Altman plots are shown in Figures 2A and 2B. The positive value of mean differnce indicated that the value of first test was generally greater than retest. Most of the mean difference of threshold were small, from -0.87 to 0.32,except CPT, CPTol, and LCPT (Table 3).

Using pair t test for examining the systemic bias from test-retest, systemic bias was found in CPT and LCPT. Among difference QST, the 95% limits of agreement LOA was smallest of CDT&WDT, and greatest of CPT.

Part II: gender, gender role and psychological factors study

268 participants (104 men and 114 women) were recruited in this study. The mean age was 41.3±17.0 (range 18-80). The mean height and weight were 163.91±8.14 (range 140-183) and 63.35±13.04 (range 40-145) respectively. The types of the gender role orientation of men and women were showed in Table 4.

Analysis the QST data distribution

Due to the method of limit was more convenient and reliable than method of level, the following statistic analyses were performed only by the data measuring by the method of limit. The QST data and logarithmically transformed for CDT and WDT due to the skewness is large, not normal distribution. (Table 3) The figure 4 showed the data distribution before and after the logarithmical transformation. In figure 3 showed the data distribution by box-plot in different sex.

Analysis the influence factors of QST

WDT and HPT were significant different between men and women ($p<0.001$). Women were perception the warm temperature change earlier (about 2.1℃) than men (about 2.8℃); and also were perception the heat pain earlier (about 7.3℃) than men (about 8.8℃). HPT was significant different among 4 gender type ($p=0.01$). The person with the androgynous orientation type was greater value than the undifferentiated type. The predict model for each QST was different and the results were showed in table 4.

Discussion

The reliability for all QSTs were high, and both in the method of limit and method of level. However, comparing the two methods, we recommend using the methods of limit due to better absolute reliability and convenient in application. The variation of CDT and WDT were small, however the variation of CPT, HPT, CPTol and HPTo were great among the participant. The predict models for CDT, WDT, CPT, HPT, CPTol and HPTo were different.

1. Reliability study

1-1. Intra-test reliability

The intra-test reliability of QSTs (CDT, CPT, HPT, CPTol and HPTo) by method of limit was excellent (Table 2). The results indicated the values of QSTs of each measure were very stable. Therefore, in the assessment, CDT and WDT sessions for 4 trials, CPT and HPT sessions for 3 trials, and CPTol and HPTo sessions for 3 trials were adequate, no need to increase the number of trials.

1-2. Test-retest reliability

1-2-1. Relative reliability

For method of limit, good to excellent reliability exam by ICC of these tests. Among the tests, WDT were lower value of ICC than the values of others tests. For method of level, similar results were found, good to excellent reliability exam by ICC of these tests. Among the tests, LWDT were lower value of ICC than others tests. (Table 2)

1-2-2. Absolute reliability

Although the relative reliabilities were similar between the method of limit and the method of level, the absolute reliability were different between the method of limit and the method of level (Table 2). The values of SEM and SRD were smaller of the method of limit then the method of level. Therefore, we suggested using the method of limit instead of using the method of level due to the convenience and better agreement of two tests (test-retest).

The SEM values of both the CDT and WDT were only 0.38, indicating the two thermal threshold perception were very sensitive, the measurement error were only 0.38. In the groups assessment, over 0.38 different could be considered as a real different. However, the SEM values of CPT and CPTol were large, 2.96 and 2.0 respectively; indicating discrimination the real difference between groups were difficult, due to measurement error were large. Similarly, the value of SRD were small for CDT and WDT and large for CPT and CPTol, due to the values of SRD were calculated from the value of SEM (Table 2).

In figure 2-A, Bland-Altman plots clearly demonstrated that the CDT and WDT with very narrow temperature range of the 95% of LOA in the method of limit. Opposite to the CDT and WDT, the CPT and CPTol were with very large temperature range of the 95% of LOA, furthermore, the mean different were deviation to negative not at the zero. In figure 2-B, very similar pattern of the Bland-Altman plots, the LCDT and LWDT with narrow temperature range (but larger than CDT and WDT from the method of limit in the figure 2-A). Therefore, we recommend using the method of limit instead using the methods of level. Furthermore, it is time consuming to the methods of level, even need more than 40 times.

2. Sex Different in QST

The results showed many difference of QST between men and women. (Figure 3) The warm perception was earlier about 0.7 degrees, and pain perception of heat was earlier about1.6 degrees. However, the HPTol were not significant different between men and women. From the box-plot of the figure 3, demonstrated the CDT, WDT of participants were small variation of both sex (figure 3A and 3B). Therefore, the CDT and WDT may is a very well indicator for differential the normal or abnormal cold detection sensation detection ability of a person. The cold change was detected after temperature decrease 2.0±1.8℃ of all participants. The warm change was detected after temperature increase 2.4±1.4℃ of all participants. However, the CPT, HPT, CPTol, and HPTol were greater variation among participants. The mean and standard deviation for CPT, HPT, CPTol, and HPTol (after temperature change from 32℃) were 13.6±9.1℃, 8.0±3.8℃, 23.7±7.7℃ and 13.9±3.3℃ respectively. The distribution conditions were shown in figure 3C to 3F. Therefore, the CPT, HPT, CPTol, and HPTol may is more useful in comparison the change of a person before and after the pathology (or management) then in assessing the normal or abnormal condition.

3. Gender Difference in QST

The gender types were classified by masculinity score (MS) and femininity score (FS). Four types of gender role orientation as follow: masculinity, femininity, androgyny, and undifferentiated. HPT was significant different among 4 gender type (p=0.01). The person with the androgynous orientation type was greater value than the undifferentiated type. The persons with undifferentiated gender type were tolerance less for heat pain. Due to the classification the four types of gender role is according to the masculinity and femininity score (the MS and FS equal and greater than 4.9 be classified as androgynous orientation, both MS and FS less than 4.9 be classified as undifferentiated orientation) the number of 4 types of participants was not equal. Most of the types of participants were undifferentiated orientation. Furthermore, whether the cutoff point (4.9 for MS and FM) is a good method that needs further studies to validate it. Therefore, in the model prediction for different type of QST, we used the continue values MS and FS as predictors instead of the type of gender orientation.

4. Predict Models for Different QST

The predict model for each QST was different and the results were showed in table 4. The QST data and logarithmically transformed for CDT and WDT due to the skewness is large, not normal distribution. (Table 3) It is interesting that the different types of sensation of thresholds and tolerances are affected by different factors. The cold detection, both the temperature change and pain perception, that age is the major factor explore by stepwise multiple linear regression analysis. The older were greater absolute value of CDT and CPT, indicating the decrease sensitivity of temperature change will occur with increase the age. However, the WDT and HPT were influenced both by sex. Furthermore, the WDT also predicted by age, but the β coefficient is small only 0.004. The masculinity score also influenced the values of the WDT, the more masculinity score predicted the higher WDT. For HPT, in addition to sex factor, higher femininity score predicted the higher HPT. The tolerance of cold pain and heat pain were both influenced by psychological factors. The CPTol were predicted by femininity score, extraversion personality and well being. The HPTol were predicted by sex, anxiety, and personality.

The regression equation for CDT as follow:

Log_A_CDT = -0.026+0.012 (age)

Log_A_CDT, the log transformed for absolute value of temperature decrease from 32 ℃ of CDT
The age factor could explain the 9.6% of the variance of CDT.

The regression equation for WDT as follow:

Log_WDT = 0.021+0.22(man)+0.004(age)+0.096(masculinity score)

Log_WDT, the log transformed for value of temperature increase from 32 ℃ of WDT
The sex, age and masculinity score factors could explain the 12.0% of the variance of WDT.

The regression equation for CPT as follow:

A_CPT = 8.65+0.12 (age)

A_CPT, the absolute value of temperature decrease from 32 ℃ of CPT
The age factor could explain the 4.7% of the variance of CPT.

The regression equation for HPT as follow:

HPT = 1.68+1.79 (man) +1.15 (femininity score)

HPT, the value of temperature increase from 32 ℃ of HPT
The sex and femininity score factors could explain the 6.6% of the variance of HPT.

The regression equation for CPTol as follow:

A_CPTol = 12.038+2.68 (femininity score) -0.530(E)+0.28(SWB)

A_CPTol, the absolute value of temperature decrease from 32 ℃ of CPTol
The femininity score, extraversion personality and well being factors could explain the 10.9% of the variance of CPTol.

The regression equation for HPTol as follow:

HPTol = 13.03+1.77(man) -0.09(BAI)+0.16(E)

HPTol, the value of temperature increase from 32 ℃ of HPTol

The sex and anxiety measured by BAI and extraversion personality factors could explain the 9.0% of the variance of HPTol.

Conclusion and suggestion

QSTs for CDT, WDT, CPT, HPT, CPTol, and HPTol were reliable in both method of limit and method of level. However comparing the methods of limit and level, we recommend using the limit instead of level method. The method of limit is convenience than method of level, and reliable in absolute reliability. CDT and CPT were predicted by age, the older with greater temperature change to perceive the threshold. Man and women are different in WDT and HPT, the women in less temperature change to detect the difference. The masculinity and femininity also influenced the QST, and the personality, well being, and anxiety influenced the tolerance of pain during the temperature change.

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Table 1 Demographic data of subjects' sensation thresholds and VAS of pain

	Total(n=28)	Men(n=14)	Women(n=14)	P value
age	21.6±2.3	21.3±1.9	21.9±2.7	0.48
In method of limit				
CDT	30.70±0.70	30.63±0.82	30.76±0.59	0.62
WDT	33.97±0.57	34.20±0.65	33.75±0.40	0.042*
CPT	19.64±9.21	14.60±11.00	24.33±2.94	0.008**
HPT	40.75±3.60	42.90±3.23	38.61±2.56	0.0006***
CPTol	6.66±6.32	4.21±4.55	9.34±7.10	0.06
HPTol	46.99±2.38	47.59±2.12	46.40±2.55	0.19
In method of level				
LCDT	29.60±1.76	28.54±1.79	30.66±0.87	0.0005***
LWDT	34.43±1.67	35.19±1.66	33.67±1.34	0.013*
LCPT	22.40±6.09	19.13±7.71	24.98±2.53	0.033*
LHPT	41.23±4.25	42.84±4.16	39.61±3.83	0.043*
Visual Analogue Scale				
VAS of CPT	2.82±1.78	2.93±1.84	2.71±1.79	0.75
VAS of HPT	3.29±1.99	3.34±2.02	3.25±2.03	0.91
VAS of CPTol	5.41±2.41	5.55±1.77	5.29±2.92	0.80
VAS of HPTol	7.02±2.07	7.20±1.22	6.84±2.71	0.65

CDT, Cold detection threshold; WDT, Warm detection threshold; CPT, Cold pain threshold; HPT, Heat pain threshold; CPTol, Cold pain tolerance; HPTol, Heat pain tolerance

Table 2. The Intra-test ,relative and absolute reliability of sensation threshold

	Test-retest Relative reliability		Test-retest absolute reliability		Intra-test reliability
	ICC	95% CI for ICC	SEM	SRD	
In method of limit					
CDT	0.75	0.47-0.89	0.38	1.08	0.84
WDT	0.65	0.24-0.84	0.38	1.06	0.70
CPT	0.84	0.48-0.89	2.96	8.22	0.97
HPT	0.88	0.75-0.95	1.22	3.38	0.92
CPTol	0.91	0.74-0.97	2.00	5.55	0.93
HPTol	0.94	0.86-0.97	0.64	1.79	0.87
In method of level					
LCDT	0.81	0.60-0.91	0.66	1.82	
LWDT	0.69	0.33-0.86	0.91	2.52	
LCPT	0.89	0.61-0.95	1.95	5.40	
LHPT	0.81	0.57-0.91	1.88	5.21	

Table 3. QST data distribution analysis and log transformation for CDT and WDT

	Range	Mean±SD	. Skewness and SE		Kurtosis and SE	
Absolute CDT	0.40-6.90	1.93±1.36	1.57	0.17	2.22	0.33
WDT	0.50-8.10	2.37±1.21	1.96	0.17	5.33	0.33
Absolute CPT	1.50-32.00	13.60±9.14	0.58	0.17	-1.07	0.33
HPT	1.70-17.60	8.00±3.80	0.50	0.16	-0.51	0.33
Absolute CPTol	5.00-32.00	23.80±7.55	-0.79	0.19	-0.56	0.38
HPTol	5.60-18.00	13.94±3.29	-0.95	0.17	-0.02	0.33
		Log transformation				
Log_A_CDT	-.92-1.93	0.45±0.63	0.38	0.17	-0.58	0.33
Log_A_WDT	-.69-2.09	0.76±0.46	0.13	0.17	0.68	0.33

Log_A_CDT, log transformation of the absolute CDT; Log_A_WDT, log transformation of the absolute WDT

Table 4. Linear regression model of QST

Dependent variable	Significant Independent variable	Regression equation	Adjusted R square	*P*
Log_A_CDT	Age	-0.026+0.012 (age)	0.096	0.001
Log_A_WDT	Sex Age Masculinity score	0.021+0.22(man)+0.004(age) +0.096(masculinity score)	0.120	0.001
CPT	Age	8.65+0.12 (age)	0.047	0.001
HPT	Sex Femininity score	1.68+1.79 (man) +1.15 (femininity score)	0.066	0.001
CPTol	Femininity score E SWB	12.038+2.68 (femininity score) -0.530(E)+0.28(SWB)	0.109	0.001
HPTol	Sex BAI E	13.03+1.77(man) -0.09(BAI)+0.16(E)	0.090	0.001

Figure 1. The mean temperature of each trials of different types of QST from the initial test of the test-retest reliability study.

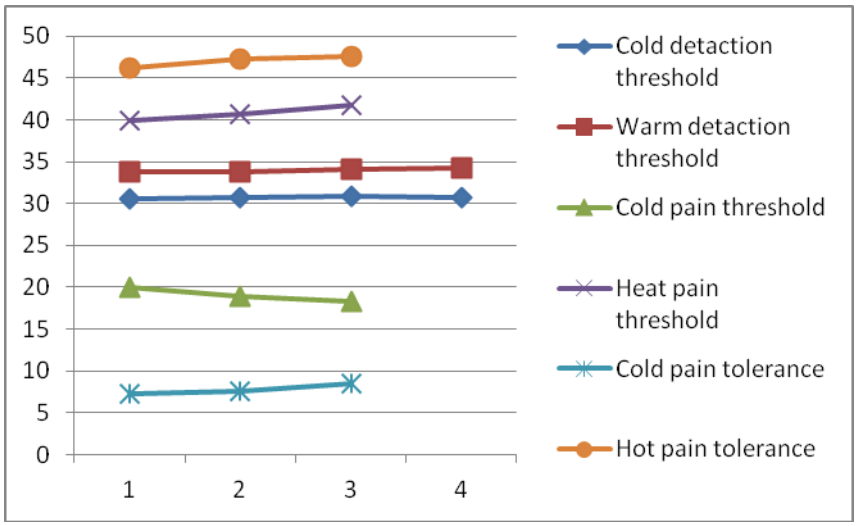


Figure 2A Bland-Altman plots for test-retest reliability in method of limit. A) CDT, B) WDT, C) CPT, D) HPT, E) CPTol, F) HPTol. The plot indicates the differences between test-retest against the mean of the 2 test for each subject. The dashed line shows 95% (±1.96 SD) limits of agreement (LOA).

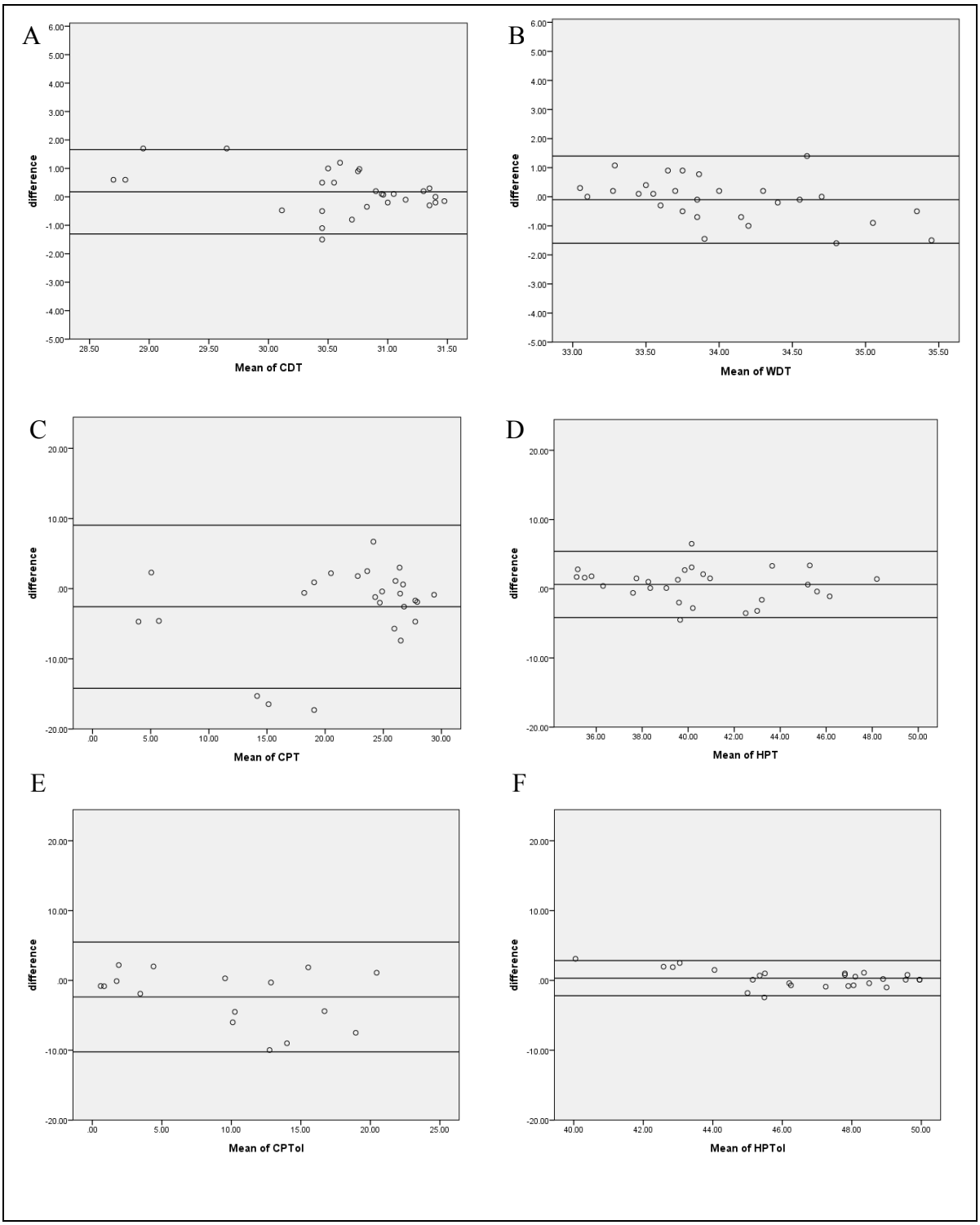


Figure 2B Bland-Altman plots for test-retest reliability in method of level. A) LCDT, B) LWDT, C) LCPT, D) LHPT. The plot indicates the differences between test-retest against the mean of the 2 test for each subject. The dashed line shows 95% (±1.96 SD) limits of agreement (LOA)..

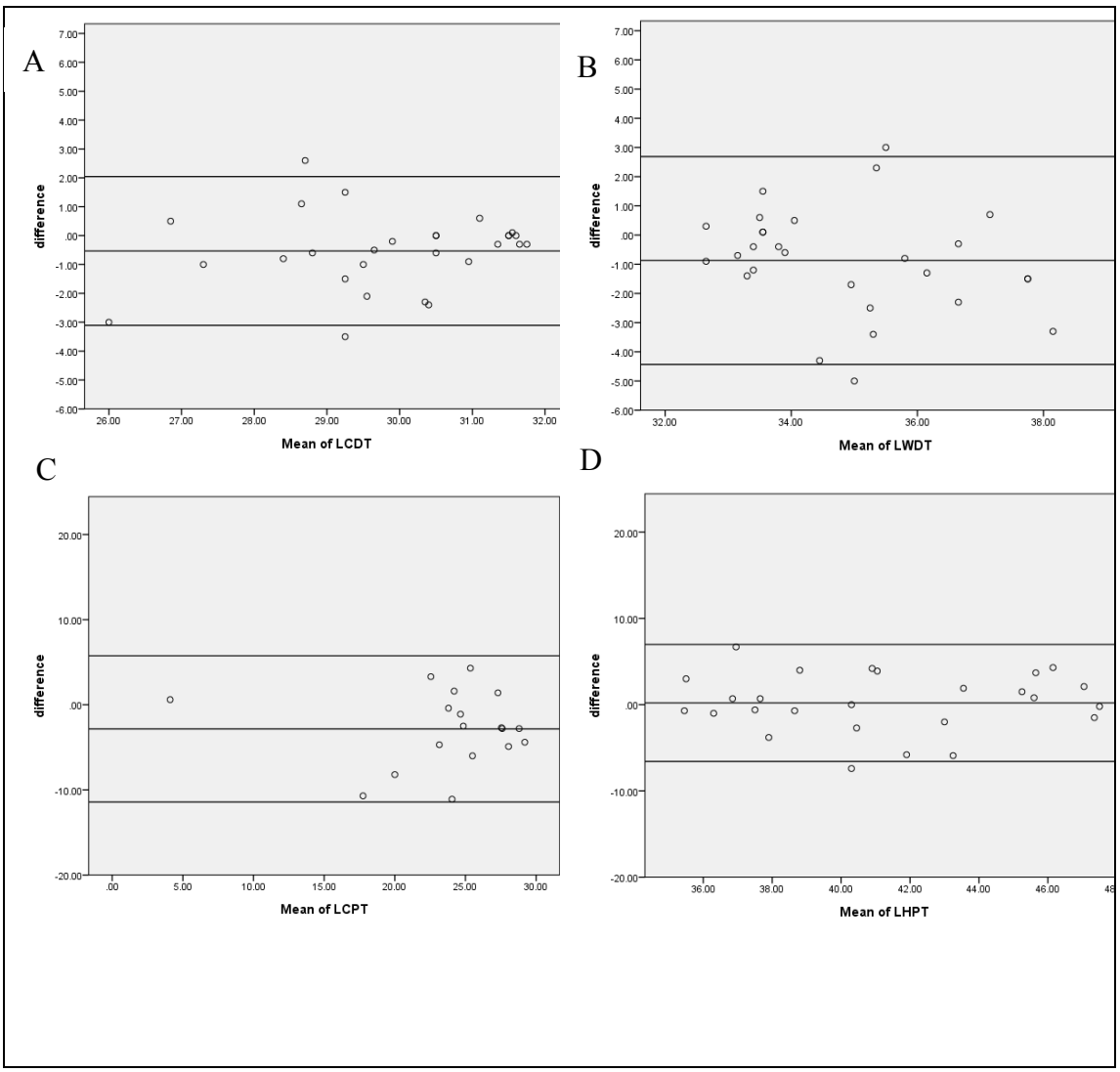


Figure 3. The box-plot of data distribution in men and women with method of limit. A) CDT, B)WDT, C)CPT, D)HPT, E)CPTol, F)HPTol.

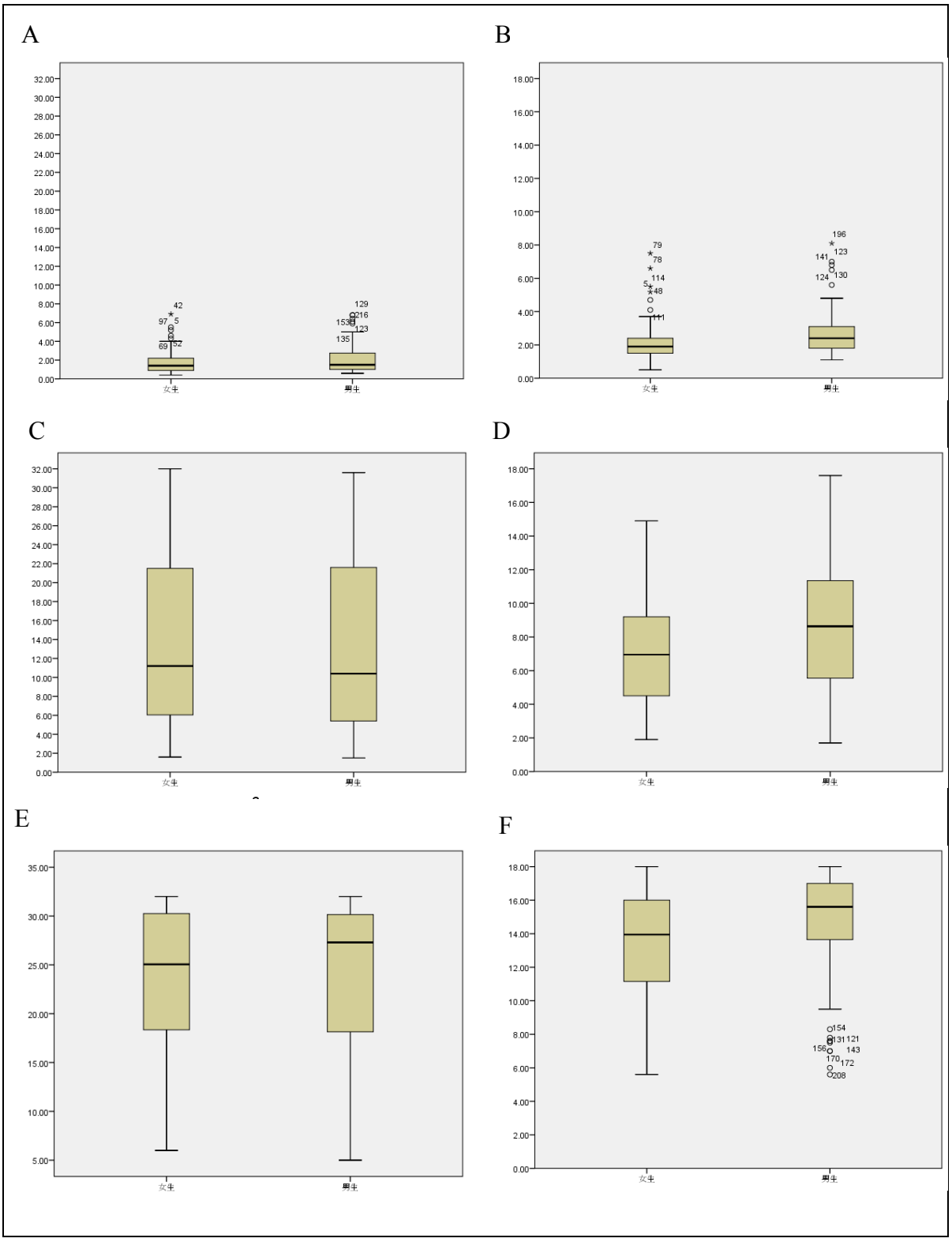
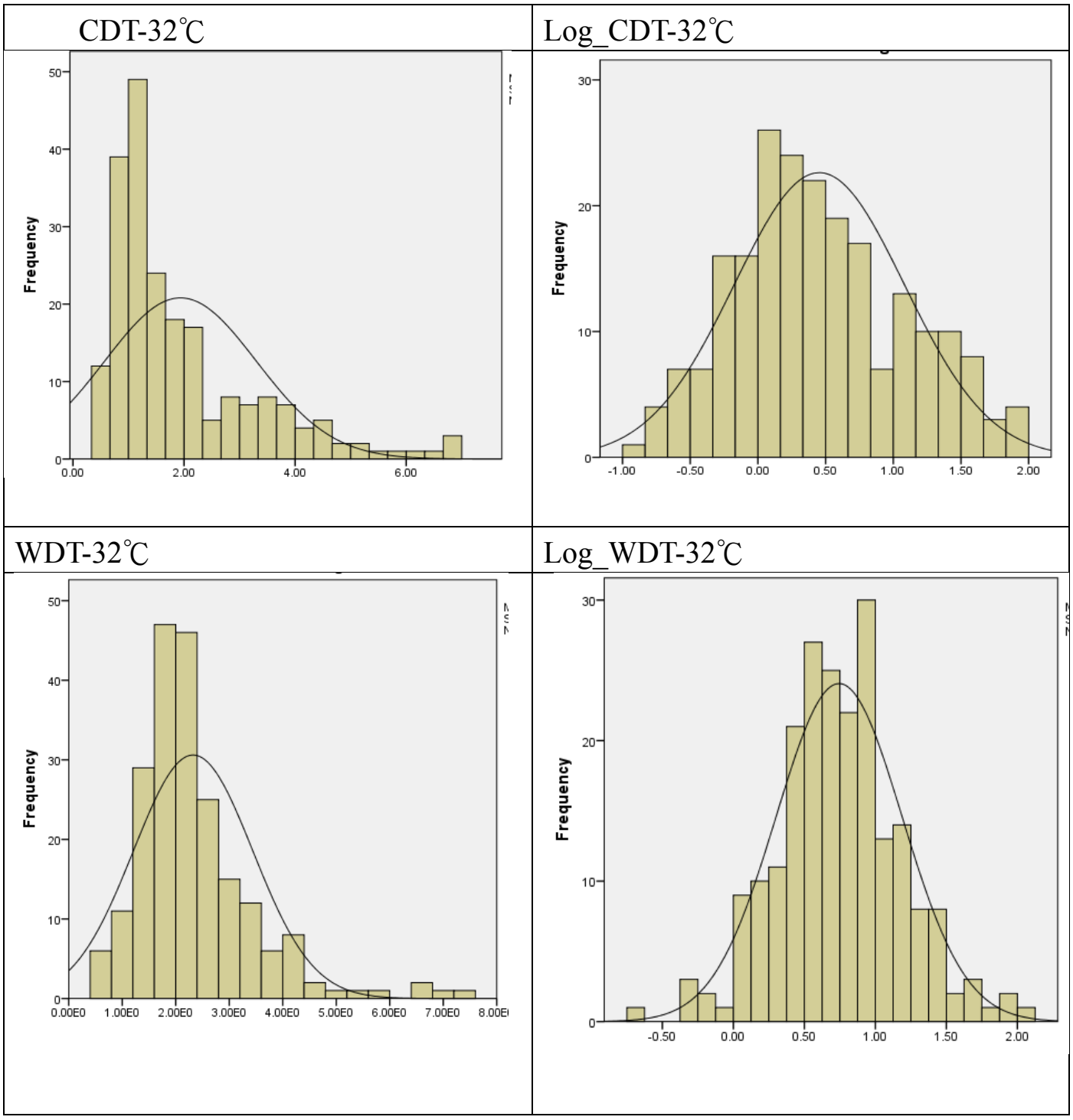


Figure 4. Logarithmically transformed of CDT and WDT.



國科會補助計畫衍生研發成果推廣資料表

日期:2013/09/13

國科會補助計畫	計畫名稱: 不同性別與性別角色在實驗性疼痛與心理因素之關連性-性別影響評估研究(GM01)
	計畫主持人: 呂怡靜
	計畫編號: 101-2629-B-037-002- 學門領域: 性別主流科技計畫

無研發成果推廣資料

101 年度專題研究計畫研究成果彙整表

計畫主持人：呂怡靜	計畫編號：101-2629-B-037-002-
計畫名稱：不同性別與性別角色在實驗性疼痛與心理因素之關連性-性別影響評估研究（GM01）	

成果項目			量化			單位	備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等）
			實際已達成數（被接受或已發表）	預期總達成數(含實際已達成數)	本計畫實際貢獻百分比		
國內	論文著作	期刊論文	1	1	100%	篇	
		研究報告/技術報告	1	1	100%		
		研討會論文	2	1	200%		
		專書	0	0	100%		
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（本國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	1	1	100%		
國外	論文著作	期刊論文	0	1	50%	篇	目前正撰寫中（預定投稿 SCI 期刊 2 篇）
		研究報告/技術報告	0	0	100%		
		研討會論文	0	0	100%		
		專書	0	0	100%	章/本	
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（外國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		

其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)	無

	成果項目	量化	名稱或內容性質簡述
科教處計畫加填項目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與（閱聽）人數	0	

國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

■達成目標

□未達成目標（請說明，以 100 字為限）

□實驗失敗

□因故實驗中斷

□其他原因

說明：

2. 研究成果在學術期刊發表或申請專利等情形：

論文：■已發表 □未發表之文稿 □撰寫中 □無

專利：□已獲得 □申請中 ■無

技轉：□已技轉 □洽談中 ■無

其他：(以 100 字為限)

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）(以 500 字為限)

本研究計畫研究實驗性疼痛的表現，先深入分析溫度測試用於疼痛評估的精確性，主要目的分析不同性別與不同性別角色在溫度疼痛評估的差異，並進一步探索疼痛與心理因素之關連性。分析溫度測試用於疼痛評估的精確程度的價值，可提供研究者、臨床工作者以溫度測試評估疼痛的正確的使用方法，可提供判讀指標。不同性別在熱溫度感覺與熱溫度痛覺有顯著的差異，研究分析發現男性化性別角色特質與女性化性別角色特質為重要預測熱溫度感覺與熱溫度痛覺數值因素，除此以外，受試者焦慮程度、外向性人格程度、神經性人格程度和幸福感程度都會左右受試者對疼痛的感受。因此影響疼痛因素應多面向考量，進一步研究發展將可針對疼痛治療時男女、性別角色特質等做妥善考量。