REGULAR ARTICLE

# Development of a questionnaire to assess 'Hie' symptoms using an evidence-based analysis

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## Abstract

*Objectives* Certain symptoms and signs are culturally specific. 'Hie' (chill sensation) is a major symptom experienced by Japanese people; however, it is not easily understood by Westerners. Although Hie is not life-threatening, it greatly hampers the quality of life in sufferers. To develop a remedy for Hie, valid and reliable measures are required. This is the first study aimed at developing a standardized questionnaire to quantitatively measure Hie symptom.

*Methods* This was a cross-sectional study. To identify question items, we conducted a literature search using published books that mention Hie and related symptoms. The first draft of the questionnaire was prepared by selecting 31 items, including three empirically used items, using the Delphi method. A total of 744 Japanese volunteers completed the draft questionnaire. Simple correlation and factor analyses were performed to select items for the final version of Hie questionnaire and for evaluating its test–retest reliability.

*Results* The following ten question items were ultimately selected: feeling a breeze, shivery feeling, tolerance, sensitivity to cold, Hie-like sensation in an airplane, dislike of air conditioning, use of gloves, use of an electric blanket, use of heavy clothing and need for heating devices. Of the ten Hie-related question items, five pertained to physical symptoms and the other five to daily behaviours. The internal consistency of the ten-item questionnaire was high, with a Cronbach's alpha of 0.85. The test–retest reliability of the questionnaire was preserved by the paired two-tailed *t* test.

*Conclusions* A new questionnaire was developed to evaluate the subjective symptom of Hie. This questionnaire demonstrated sufficient reliability and could be used as a tool to assess this symptom.

**Keywords** Culture · Hie · Japan · Questionnaires · Traditional medicine

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## Introduction

Ever-intensifying globalization indicates the importance of cultural backgrounds in medicine. The manifestation and risk of diseases are closely related to culture, and certain culturally specific symptoms are of potential importance in the medical field [1, 2].

'Hie' refers to a chill sensation; however, it does not merely indicate a sensation caused by low temperatures as defined by Western medicine [3]. Rather, it encompasses a wider variety of uncomfortable sensations that cause various complaints, and it has a large negative impact on the quality of life (QoL) of the sufferer. Although Westerners

are unfamiliar with the concept of Hie [3], it is one of the most common symptoms in Japan. According to an earlier epidemiologic study, 50–60% of Japanese women have reported experiencing Hie symptoms in their daily lives [4, 5]. Based on a study conducted during the winter, Japanese men who worked outdoors experienced Hie more frequently than other symptoms [6]. Hie is frequently expressed as manifestations of partial symptoms of autonomic liability or accumulated fatigue in daily life.

Hie is clinically important because it frequently arises from diseases. For example, cardiovascular diseases, such as arteriosclerosis obliterans (ASO) and thromboangiitis obliterans (TAO), are some of the major disorders causing Hie, and 40% of type 2 diabetes patients complain of a cold sensation in their lower extremities [4]. Raynaud's phenomenon [7, 8], leprosy [9], and reflux sympathetic dystrophy (RSD) [10] are also associated with Hie. Consequently, Hie should be medically treated regardless of its aetiology because of its high prevalence and serious impact on normal daily activities.

In the oldest book of traditional Chinese medicine (TCM), Kotei-naikei (202 B.C.–A.D. 8) mentions Hie and classifies it into two groups based on symptomatology: 'Ketsu-kan', which is subjective Hie without a decreased body temperature, and 'Ketsu-rei', which is subjective Hie with a decreased body temperature [11]. Ketsu-kan may develop from an autonomic liability or psychological crisis, while Ketsu-rei may be mainly caused by diseases or may occur as a simple phenomenon of heat dissipation from the body to the air. The human body has a mechanism to maintain homeostasis; however, an individual suffering from prolonged symptoms should seek medical evaluation. Currently, no common measure has been used for evaluating Hie, and patients generally express this symptom using their own criteria.

It is essential to be able to evaluate the subjective concept of Hie in detail in order to comprehend its nature and develop remedies for all types of Hie. We have therefore developed a questionnaire to assess Hie in a Japanese population using a three-step procedure: (1) composing questions related to Hie based on pre-existing published material, (2) selecting question items using both simple correlation and factor analyses and (3) evaluating the reliability of the questionnaire.

## Materials and methods

### Development of a draft questionnaire

To concretize the concept of Hie explicitly for the literature search, we defined it as a subjective chill sensation under warm environmental conditions or as behaviour to projecting that sensation. Candidate questions were identified by searching published books that mention Hie and related symptoms using the internet databases MEDLINE (English), PsychINFO (English), 'Ichushi' (Japanese) and 'Amazon.com' (both English and Japanese). A panel consisting of two vascular surgeons, one Chinese medicine expert, one physician specialized in mind and body medicine, and one epidemiologist was formed. The panel members developed the Hie questions independently and discussed the questions based on information reported in previous publications as well as their own personal knowledge based on clinical and research experience in meetings that were conducted once a month for a total of 3 months. The Delphi method was used to select Hie question items for the draft questionnaire [12]. Prior to distributing the draft questionnaire to the study participants, it was preliminarily tested in ten people who were independent of the study, and its language was finally refined to facilitate understanding of the questions.

In addition to the question items, one screening item (yes/no question) and the following three empirically used items were included in the questionnaire: one visual analogue scale (VAS) for the severity of Hie (scores, 0–10) and two Likert scales (scores, 1–5) for the frequency of Hie and the interference level caused by Hie in daily life, respectively.

### Development of the final questionnaire

After obtaining informed consent for participation, the draft questionnaire was distributed to 800 university employee volunteers and their family members. All Japanese and aged between 18 and 73 years. The final questionnaire was created as follows.

Exclusion criteria for new items were based on a lack of association with the following items: (1) screening item (yes/no question); (2) all three empirically used items; (3) other new items. Simple correlation analyses were performed for the new items and the other four items (one screening and three empirically used items). The intercorrelation matrix of each item was analysed using Spearman's correlation coefficients, and the reliability of the questionnaire was assessed using Cronbach's alpha test of internal consistency. A principal factor analysis was conducted to determine the nature of the domains of the selected items. Common factors were extracted, and the axes were rotated using the varimax method. As such, the final version of the Hie questionnaire was completed.

### Test–retest reliability

The final version of the questionnaire was completed by 120 nursing students (108 women and 12 men, aged

19–27 years). The same questionnaire was administered twice in the autumn (2-week interval) and twice in the winter (2-week interval).

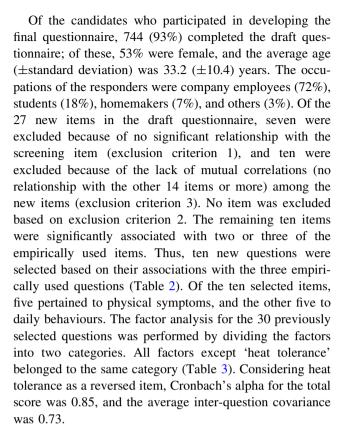Relationship with psychological factors

To determine the psychological factors that may confound or amplify Hie, the same nursing students were evaluated for three major psychological factors (anxiety, depression and hypochondria) using a profile of mood states (POMS) [13] and somatosensory amplification scale (SSAS) [14]. The POMS comprises 65 items with six mood state subscales: tension–anxiety, depression, anger–hostility, vigour, fatigue and confusion. The tension–anxiety and depression subscales were analysed; they are particularly relevant because increased use of medical care tends to elevate the distress levels on these scales [15]. The reliability and validity of POMS has been previously examined in a Japanese population [16]. The SSAS is designed to assess the perceptual style of somatizing conditions, and a higher total score indicates greater symptom amplification. The Japanese version of SSAS has been shown to have good intra-scale consistency (Cronbach's alpha = 0.79) as well as construct and criterion validity [17, 18].

Ethics

All of the procedures of the study were performed after receiving the approval of the Teikyo University Ethics Committee. Prior to completing the questionnaire, each participant provided written informed consent accompanied by a statement of compliance with the Code of Ethics of the World Medical Association (Declaration of Helsinki). For the selection of valid question items for the final questionnaire, the results of the completed questionnaires were coded, recorded and analysed; private information was eliminated.

**Results**

The literature search of the English database did not reveal any studies of Hie, while that of the Japanese database revealed 1302 studies related to Hie and 65 studies were related to symptoms. Based on an expert review of 65 studies, a total of 31 questions (one yes/no question, three empirically used items, ten questions pertaining to physical symptoms of Hie and 17 questions to daily behaviours related to Hie) were selected for the draft questionnaire (Table 1). A 5-point scale (scores 1–5) was used for all the items excluding the yes/no question and VAS, which indicates Hie severity.

Of the candidates who participated in developing the final questionnaire, 744 (93%) completed the draft questionnaire; of these, 53% were female, and the average age (±standard deviation) was 33.2 (±10.4) years. The occupations of the responders were company employees (72%), students (18%), homemakers (7%), and others (3%). Of the 27 new items in the draft questionnaire, seven were excluded because of no significant relationship with the screening item (exclusion criterion 1), and ten were excluded because of the lack of mutual correlations (no relationship with the other 14 items or more) among the new items (exclusion criterion 3). No item was excluded based on exclusion criterion 2. The remaining ten items were significantly associated with two or three of the empirically used items. Thus, ten new questions were selected based on their associations with the three empirically used questions (Table 2). Of the ten selected items, five pertained to physical symptoms, and the other five to daily behaviours. The factor analysis for the 30 previously selected questions was performed by dividing the factors into two categories. All factors except 'heat tolerance' belonged to the same category (Table 3). Considering heat tolerance as a reversed item, Cronbach's alpha for the total score was 0.85, and the average inter-question covariance was 0.73.

Of the 122 (93%, first time) candidate nursing students who evaluated both the test–retest reliability and the association with psychological factors, 94 (78%, fourth time), including nine men, completed the final questionnaire.

After the final version of the ten-item Hie questionnaire had been created, a total score for Hie was calculated by summing up each item score (range 10–50 points), and four levels of Hie were defined based on the total score with 10-point intervals (i.e. 'not apparent' < 20; 20 < 'slight' < 30; 30 < 'moderate' < 40; 'severe' > 40). The test–retest reliability of the total score was preserved for all levels of Hie during the administration of the questionnaire in both the autumn and winter (twice in each season, with 2-week intervals, for a total of four times) (Table 4).

The total scores, regardless of the levels, were not related to the three psychological factors: tension–anxiety, depression and hypochondria (Table 5).

**Discussion**

Our newly developed Hie questionnaire comprising ten question items appears to be a valid and reliable tool to measure Hie. The questionnaire attempts to evaluate subjective Hie taking seasonal effects into consideration. No significant relationships were observed between this symptom and major psychological factors that may confound and amplify the subjective feeling of Hie.

**Table 1** Characteristics of the first draft of the Hie questionnaire

| Questions | Frequency | Mean ± standard deviation |
|---|---|---|
| Screening item | | |
| 1. Hie (yes or no) | 732 | Yes: 655 |
| Empirically used items | | |
| 2. Severity of Hie | 734 | 3.6 ± 3.0 |
| 3. Frequency of Hie | 655 | 1.7 ± 1.5 |
| 4. Disability in daily living caused by Hie | 725 | 0.9 ± 1.1 |
| Newly selected items | | |
| 5. Hie with numbness[b] | 699 | 0.7 ± 1.2 |
| 6. Hie with pricking feeling[b] | 697 | 0.6 ± 1.0 |
| **7. Hie with breezed feeling** | 706 | 1.5 ± 1.5 |
| **8. Hie with shivery feeling** | 700 | 1.2 ± 1.4 |
| 9. Hie with pain[b] | 695 | 0.4 ± 0.9 |
| 10. Hie with swelling[b] | 703 | 0.7 ± 1.2 |
| 11. History of hyperperspiration[a] | 736 | 1.8 ± 1.5 |
| **12. Heat tolerance** | 738 | 1.7 ± 1.5 |
| **13. Sensitivity to cold** | 739 | 3.3 ± 1.3 |
| **14. Hie-like sensation in an airplane cabin** | 734 | 2.4 ± 1.5 |
| 15. Reluctance to use tap water (cold water)[b] | 737 | 2.8 ± 1.4 |
| **16. Reluctance to use air conditioning in summer** | 738 | 2.2 ± 1.3 |
| **17. Use of gloves or socks for Hie protection** | 736 | 2.9 ± 1.6 |
| **18. Use of additional layers of clothing for Hie protection** | 737 | 2.3 ± 1.5 |
| 19. Requirement of foot bathing for Hie protection[b] | 739 | 1.8 ± 1.1 |
| **20. Use of an electric blanket or a foot warmer while sleeping** | 738 | 2.1 ± 1.4 |
| **21. Requirement of heating devices in winter** | 738 | 3.0 ± 1.5 |
| 22. Dislike of skiing or skating because of the cold[b] | 736 | 2.4 ± 1.5 |
| 23. Practising Seiza (sitting on one's heels) or Agura (sitting cross-legged)[a] | 739 | 3.2 ± 1.2 |
| 24. Feeling good when sleeping with legs raised[a] | 737 | 3.3 ± 1.1 |
| 25. Relief from Hie after playing sports[a] | 734 | 3.6 ± 0.9 |
| 26. Relief from Hie after performing relaxing exercises (e.g. yoga, stretching)[a] | 732 | 3.3 ± 0.9 |
| 27. Dislike of cold drinks and foods[b] | 737 | 1.7 ± 1.0 |
| 28. Dislike of vegetables[a] | 737 | 1.5 ± 1.0 |
| 29. Reaction to room temperature (inner) different from others[b] | 740 | 3.0 ± 1.2 |
| 30. Reaction to air temperature (outer) different from others[a] | 740 | 2.8 ± 1.1 |
| 31. Use of a personal heater at one's work place[b] | 731 | 1.5 ± 1.0 |

All questions were on 5-point Likert scales, excluding the yes/no question and that regarding the severity of Hie estimated using the visual analogue scale (0–10). The items in bold were selected for the final questionnaire

[a] Questions excluded from the final questionnaire that were not related to the dichotomous Hie question

[b] Questions excluded from the final questionnaire that were not related to the other questions in the first draft

Of the selected ten question items, five pertained to physical symptoms and the other five to daily behaviours. Participants with Hie accompanied with a 'breezed and shivery feeling' were included, while those with 'numbness, pricking feeling, pain and swelling' were excluded. The excluded symptoms generally coexist with neurological diseases; hence, including healthy participants in the study would affect the results. Patients with Hie would respond to the questionnaire differently.

A 'feeling of cold' can be interpreted as a 'sensitivity to cold'. Some Japanese people are reluctant to directly express their symptoms and prefer to imply them instead [18]. Interestingly, a 'Hie-like sensation in an airplane cabin' was selected because patients experience this symptom in an airplane cabin environment. Hie is often attributed to a circulatory deficit due to vasoconstriction [4]. Restricted conditions during long flights can trigger this symptom; additionally, autonomic liability is affected

**Table 2** Spearman's correlation of empirically used and newly selected questions

| Questions | 1 | 2 | 3 | 4 | 7 | 8 | 12 | 13 | 14 | 16 | 17 | 18 | 20 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Screening item | | | | | | | | | | | | | | |
| 1. Hie (yes or no) | – | * | * | * | * | * | * | * | * | * | * | * | * | * |
| Empirically used items | | | | | | | | | | | | | | |
| 2. Severity of Hie | 0.43 | – | * | * | * | * | * | * | * | * | * | * | * | * |
| 3. Frequency of Hie | 0.15 | 0.81 | – | * | * | * | * | * | * | * | * | * | * | * |
| 4. Disability in daily living | 0.35 | 0.73 | 0.66 | – | * | * | NS | * | * | * | * | * | * | * |
| Newly selected items | | | | | | | | | | | | | | |
| 7. Hie with breezed feeling | 0.32 | 0.61 | 0.59 | 0.54 | – | * | * | * | * | * | * | * | * | * |
| 8. Hie with shivery feeling | 0.25 | 0.55 | 0.53 | 0.53 | 0.57 | – | NS | * | * | * | * | * | * | * |
| 12. Heat tolerance | −0.21 | −0.18 | −0.16 | −0.12 | −0.15 | −0.07 | – | * | NS | * | * | ** | NS | NS |
| 13. Sensitivity to cold | 0.14 | 0.33 | 0.27 | 0.30 | 0.20 | 0.28 | −0.11 | – | * | * | * | * | * | * |
| 14. Hie-like sensation in an airplane | 0.35 | 0.58 | 0.53 | 0.51 | 0.46 | 0.51 | −0.09 | 0.32 | – | * | * | * | * | * |
| 16. Reluctance to use air conditioning | 0.23 | 0.36 | 0.33 | 0.34 | 0.31 | 0.29 | −0.21 | 0.20 | 0.38 | – | * | * | * | * |
| 17. Use of gloves | 0.28 | 0.56 | 0.52 | 0.52 | 0.44 | 0.45 | −0.17 | 0.22 | 0.53 | 0.36 | – | * | * | * |
| 18. Use of additional clothing | 0.26 | 0.51 | 0.48 | 0.46 | 0.42 | 0.44 | −0.13 | 0.25 | 0.53 | 0.34 | 0.62 | – | * | * |
| 20. Use of an electric blanket | 0.30 | 0.50 | 0.45 | 0.45 | 0.33 | 0.36 | −0.11 | 0.23 | 0.47 | 0.26 | 0.46 | 0.43 | – | * |
| 21. Requirement of heating devices | 0.28 | 0.57 | 0.53 | 0.49 | 0.44 | 0.44 | −0.12 | 0.25 | 0.53 | 0.33 | 0.57 | 0.47 | 0.54 | – |

The first four items (yes/no, severity, frequency and disability) were excluded from the final questionnaire because they were not related to the empirically used questions

*NS* not significant

*$P < 0.01$, **$P < 0.05$ using Bonferroni-adjusted significance level. In all of the analyses, the observational numbers ranged from 624 (i.e. frequency of Hie vs. Hie with shivery feeling) to 737 (e.g. use of a heating device vs. using an electric blanket)

by the extraordinary environment in an airplane cabin and may exacerbate the symptom.

Heat tolerance showed different characteristics from the other nine selected items; on occasion, it can suggest a hormonal imbalance. Some researchers have reported that the female hormone oestrogen and its vascular endothelial and smooth muscle cell receptors play a direct role in vasodilatation by relaxing the corresponding cells and producing nitric oxide that also causes vasodilation [19]. Given the factors selected, the combination of autonomic nerve imbalance and hormonal imbalance may cause or exacerbate Hie. Furthermore, the five selected questions on daily behaviours were associated with protection from the cold, indicating that those who experience the symptom protect themselves against the cold sensation by using clothes or heating devices.

This study has at least four limitations related to the survey sample, internal consistency and seasonal changes. One major limitation is external generalizability. Most Japanese people are familiar with the concept of Hie and can easily answer Hie-related questions; however, this would be difficult for people who are unfamiliar with this symptom. Although the questionnaire has a few questions regarding Hie-related behaviour that may help to identify people who are unfamiliar with Hie, we advocate another study in a different culture.

Additionally, the internal consistency of the questionnaire might not be robust because the factor analysis revealed that one item had characteristics that were different from the other items. However, the selected item heat tolerance was not excluded based on the exclusion criteria because it provides important evidence that indicates that hormonal imbalances, particularly in women, may cause Hie [11, 19]. Further, Hie was evaluated based on the total score of the final questionnaire that demonstrated sufficient validity and reliability. Seasonal changes may be another concern. The average of the total Hie scores varied from 20 in winter to 26 in autumn (Table 4). When using this questionnaire, examiners should take into account seasonal or temperature variations. Conducting the same study in spring and summer would be ideal for future research. Finally, this study mainly focused on the reliability of the Hie questionnaire; consequently, further studies with an adequate investigation of both validity and reliability are warranted for clinical application.

Despite these limitations, we propose that this Hie questionnaire will have a sufficient reliability in healthy people. The next step is to confirm its usefulness in clinical trials, taking into account the abovementioned limitations. To investigate the mechanism of Hie, additional research that compares the results of the questionnaire using a thermograph would be interesting.

**Table 3** Results of the factor analysis for the draft of the Hie questionnaire

| Questions | Factor loadings | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| 2. Severity of Hie | **0.77** | 0.08 | −0.25 | −0.10 |
| 3. Frequency of Hie | **0.78** | 0.06 | −0.19 | −0.04 |
| 4. Disability in daily living caused by Hie | **0.68** | 0.08 | −0.25 | −0.03 |
| 5. Hie with numbness | 0.37 | 0.02 | **−0.67** | 0.00 |
| 6. Hie with pricking feeling | 0.38 | −0.01 | **−0.63** | 0.04 |
| **7. Hie with breezed feeling** | *0.64* | 0.07 | 0.02 | −0.03 |
| **8. Hie with shivery feeling** | *0.62* | 0.11 | −0.17 | −0.03 |
| 9. Hie with pain | 0.36 | 0.02 | **−0.51** | 0.04 |
| 10. Hie with swelling | **0.52** | 0.03 | −0.13 | −0.01 |
| 11. History of hyperperspiration | −0.10 | 0.29 | 0.01 | **0.63** |
| **12. Heat tolerance** | −0.18 | 0.34 | −0.06 | *0.64* |
| **13. Sensitivity to cold** | *0.45* | 0.20 | −0.05 | −0.31 |
| **14. Hie-like sensation in an airplane cabin** | *0.66* | 0.10 | −0.14 | −0.14 |
| 15. Reluctance to use tap water (cold water) | **0.41** | 0.13 | −0.14 | −0.20 |
| **16. Reluctance to use air conditioning in summer** | *0.43* | 0.12 | 0.03 | −0.22 |
| **17. Use of gloves or socks for Hie protection** | *0.65* | 0.05 | −0.07 | −0.12 |
| **18. Use of additional layers of clothing** | *0.62* | 0.08 | −0.03 | −0.12 |
| 19. Requirement of foot bathing for Hie protection | **0.50** | 0.11 | −0.03 | −0.18 |
| **20. Use of an electric blanket while sleeping** | *0.55* | 0.17 | −0.14 | −0.08 |
| **21. Requirement of heating devices in winter** | *0.63* | 0.14 | −0.11 | −0.17 |
| 22. Dislike skiing or skating because of the cold | **0.30** | 0.17 | −0.07 | −0.21 |
| 23. Practising Seiza or Agura | 0.09 | 0.03 | 0.02 | 0.13 |
| 24. Feeling good when sleeping with raised legs | 0.24 | −0.02 | 0.11 | 0.12 |
| 25. Relief from Hie after playing sports | **0.34** | −0.16 | 0.29 | 0.21 |
| 26. Relief from Hie after performing relaxing exercises | **0.43** | −0.11 | 0.30 | 0.16 |
| 27. Dislike of cold drinks and foods | 0.34 | 0.22 | −0.03 | **−0.43** |
| 28. Dislike of vegetables | 0.07 | 0.17 | −0.11 | **−0.33** |
| 29. Reaction to room temperature different from others | 0.14 | **0.80** | 0.01 | 0.13 |
| 30. Reaction to air temperature different from others | 0.13 | **0.78** | −0.03 | 0.06 |
| 31. Use of a personal heater at one's workplace | **0.33** | 0.18 | −0.12 | −0.16 |

Eigenvalue was set above 1 (factor 1 = 7.6, factor 2 = 1.8, factor 3 = 1.2, factor 4 = 1.1), and the cumulative contribution rate was 91% in the analysis. The numbers in bold are the main loading value of each item. The numbers in bold + italics are the main loading values of the ten selected items. The Hie (yes or no) question was excluded from the analysis because it was a dichotomous question

**Table 4** Test–retest reliability of the final Hie questionnaire

| | Autumn | | | | | Winter | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | First time | | Second time | | *P* | First time | | Second time | | *P* |
| | *N* | Mean ± SD | *N* | Mean ± SD | | *N* | Mean ± SD | *N* | Mean ± SD | |
| Total score of the Hie questionnaire | 112 | 26.9 ± 7.7 | 108 | 26.2 ± 7.9 | NS | 108 | 20.3 ± 7.9 | 94 | 20.3 ± 8.7 | NS |
| Level of Hie | | | | | | | | | | |
| Severe | 5 | 41.4 ± 1.5 | 5 | 40.8 ± 1.1 | NS | 0 | – | 0 | – | |
| Moderate | 46 | 32.9 ± 2.5 | 38 | 33.3 ± 2.5 | NS | 9 | 33.3 ± 2.5 | 14 | 32.1 ± 2.4 | NS |
| Slight | 38 | 24.5 ± 2.7 | 38 | 24.6 ± 2.8 | NS | 54 | 24.4 ± 3.0 | 42 | 24.5 ± 2.7 | NS |
| Not apparent | 23 | 15.7 ± 2.7 | 27 | 15.9 ± 2.6 | NS | 45 | 12.7 ± 5.1 | 38 | 11.3 ± 4.8 | NS |

Total score of Hie ranged from 10 to 50 points. The levels of Hie were defined as follows: Severe ≥40, 30< moderate <40, 20≤ slight <30, not apparent <20. Test–retest reliability was evaluated by the paired *t* test (two-tailed) using Satterthwaite's approximation for adjusting unequal variances

*NS* not significant

**Table 5** Relationship between Hie scores and psychological factors

| | POMS | | | | | | | SSAS | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Tension-anxiety | | | Depression | | | | | |
| | n | Correlation coefficient | P | n | Correlation coefficient | P | n | Correlation coefficient | P |
| Total score of the Hie questionnaire | 104 | −0.01 | NS | 106 | 0.08 | NS | 105 | 0.18 | NS |
| Levels of Hie | | | | | | | | | |
| Severe | 4 | 0.91 | NS | 4 | 0.83 | NS | 4 | 0.41 | NS |
| Moderate | 42 | −0.11 | NS | 43 | 0.02 | NS | 43 | 0.24 | NS |
| Slight | 35 | −0.22 | NS | 36 | −0.14 | NS | 35 | −0.09 | NS |
| Not apparent | 23 | 0.13 | NS | 23 | 0.17 | NS | 23 | 0.29 | NS |

The total score and levels of Hie have been defined in Table 4. Hie scores used in the analysis were obtained in the autumn (first trial) at which time the POMS and SSAS data were collected

*POMS* profile of mood states, *SSAS* somatosensory amplification scale, *NS* not significant

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