

## Original Article

# The definition and diagnosis of cold hypersensitivity in the hands and feet: Finding from the experts survey



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## ABSTRACT

**Background:** Cold hypersensitivity in the hands and feet (CHHF) is a symptom patients usually feel cold in their hands and feet, but not dealt with a disease in western medicine. However, it is often appealed by patients at a clinic of Korean medicine (KM), considered to be a sort of key diagnostic indicator, and actively treated by physicians. Nevertheless, there is no standardized diagnostic definition for CHHF. Therefore, we surveyed KM experts' opinions to address the clinical definition, diagnostic criteria, and other relevant things on CHHF.

**Methods:** We developed a survey to assess the definition, diagnosis, causes, and accompanying symptoms on CHHF. 31 experts who work at specialized university hospitals affiliated

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Cold hypersensitivity  
Cold extremities  
Cold constitution

with KM hospitals consented to participation. Experts responded to survey questions by selecting multiple-choice answers or stating their opinions.

**Results:** Vast majority of experts (83.8%) agreed with our definition on CHHF (“a feeling of cold as a symptom; that one’s hands or feet become colder than those of average people in temperatures that are not normally perceived as cold”). 77.4% of experts considered subjective symptoms on CHHF were more important than medical instrument results. Constitution or genetic factors (87.1%) and stress (64.5%) were the most common causes reported for CHHF. **Conclusions:** This study offers an expert consensus regarding the themes, opinions, and experiences of practitioners with CHHF. Our results underscore the need for standardized definitions and diagnostic criteria for CHHF.

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## 1. Introduction

Cold hypersensitivity in the hands and feet (CHHF) describes a sensation of noxious cold in a patient’s extremities even at a room temperature. CHHF is most commonly found in women of Asian ethnicity.<sup>1</sup> The exact cause of CHHF is currently unknown, but it is generally supposed to be caused by the contraction of blood vessels in the extremities due to mental stress, neurovascular disease, or medical factors.<sup>1–3</sup>

In cases where CHHF has an organic cause, appropriate treatment can be identified and administered. However, most patients present with CHHF symptoms in the absence of any apparent underlying organic cause. For this reason, Western medicine tends to focus on lifestyle management rather than the treatment of any disease. Korean medicine (KM), however, regards CHHF as a key indicator for cold pattern identification, and treats it with acupuncture, moxibustion, and various Korean herbal medicines.<sup>4–7</sup>

Patients suffering from CHHF can present with diverse clinical manifestations including objective symptoms such as Raynaud’s phenomenon accompanying changes in skin color or subjective symptoms feeling cold in hands and feet. Therefore, the diagnosis of CHHF can differ according to the diagnostic procedures performed and the perception of the attending physician. To this end, a plethora of studies have been performed to validate and standardize the description of CHHF. Existing studies characterizing CHHF have suggested the use of digital infrared thermography imaging (DITI),<sup>8</sup> the cold stress test (CST),<sup>9</sup> heart rate variability (HRV), red blood cell deformability tests, and peripheral nerve tests for diagnosis or evaluation. In spite of these efforts, there is still no consensus on the diagnostic guidelines for CHHF.<sup>10–12</sup>

Therefore, the goal of the present study was to evaluate the CHHF symptoms and develop a clinical basic information for diagnosis and treatment. We surveyed CHHF experts in order to provide consensus data on the definition, diagnosis, causes, and associated symptoms and disease of CHHF.

## 2. Methods

### 2.1. Survey contents

To design an effective survey, five practitioners, who were specialized in one of the preventive medicines, two of

the internal medicines, and two of the gynecological medicines, prepared questions based on existing CHHF research. The contents of the survey included five different types of associated themes on CHHF. There were five themes as follows: the definition, diagnosis (diagnostic medical instruments, giving weight between skin temperature or subjective symptoms, agreement regarding the diagnostic index of the difference between proximal and distal peripheral skin temperature<sup>8</sup>), causes, pattern identification, and accompanied symptoms and disease (Supplementary table 1).

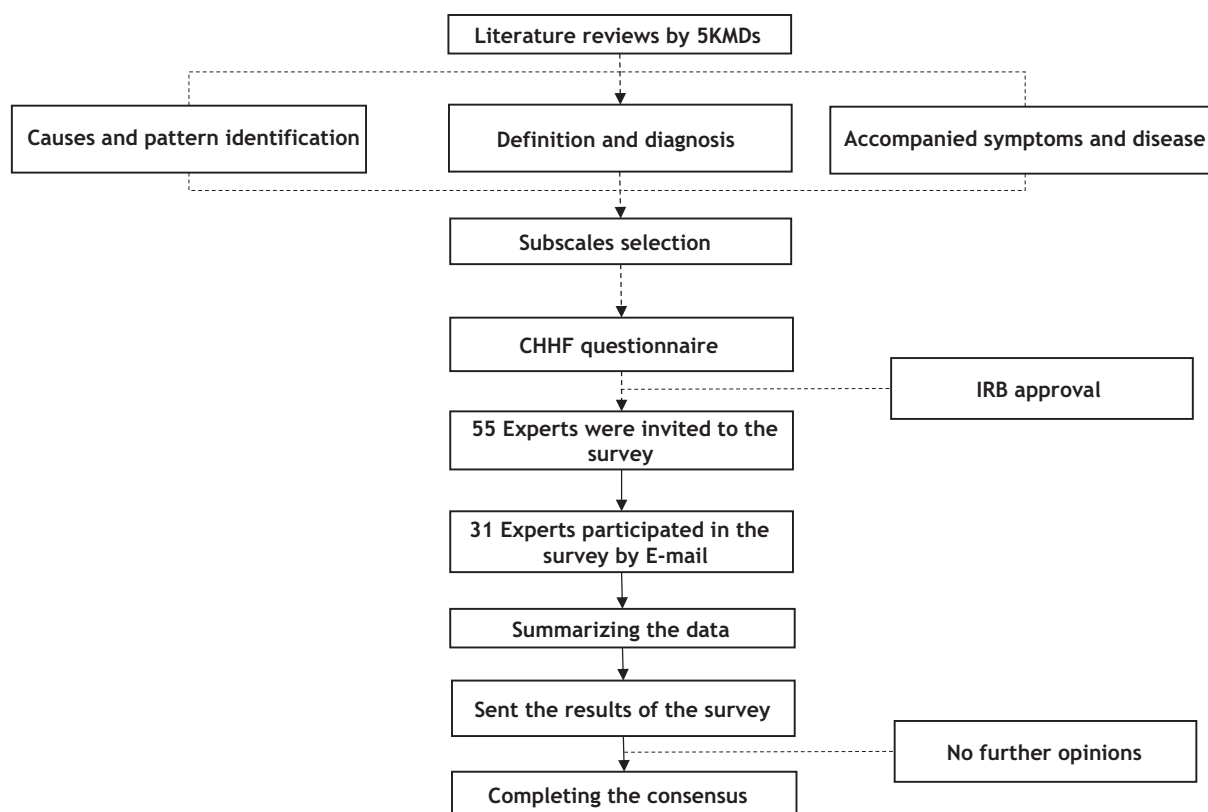
The survey was formatted into multiple-choice questions or alternatively allowed respondents to select “Other” and provide comments. Respondents selected the top three causes of CHHF, the top two causes of pattern identification, and multiple answers for the accompanying symptoms and diseases.

### 2.2. Subjects

We contacted 55 CHHF experts from specialized university hospitals that were affiliated with KM hospitals between February and April of 2014. Among these individuals, 31 experts replied and agreed to participate in our survey. The number of respondents for each question was different in some cases. In this study, “expert” was defined as a physician in a department of KM with knowledge in the field of CHHF that was actively treating CHHF patients in a specialized hospital affiliated with KM hospitals, and had taught students in the departments of gynecology or internal medicine.

### 2.3. Research procedures

It was requested to a survey company at January 2014 in order to conduct this survey, where any of the media such as telephone, email, or message were used to each expert. The survey text was sent and took by an e-mail, and the survey was finished on April 30, 2014. Supplemental opinions asking if they felt that the survey topics needed further investigation, and a query was also requested asking whether any other suggestion is need or not. No additional opinions were provided,



**Fig. 1 – The flow chart of the survey progress.**

**KMD, Korean medicine doctor; IRB, institution review board; CHHF, cold hypersensitivity in the hands and feet.**

and we again sent final results to each expert. As a result, the project ended with a single tabulation of participant responses (Fig. 1).

#### 2.4. Ethical considerations and statistical analysis

This study was reviewed and approved by the Institution Review Board (IRB) of Kyung Hee University (KHSIRB-14-012). Every participant agreed with this research by acknowledging through an e-mail.

Software Package for Social Sciences (SPSS) version 21.0 for Windows (IBM Corp., Armonk, NY, USA) was used for statistical analysis. Frequency was analyzed for each survey item.

### 3. Results

#### 3.1. General characteristics

Of the 31 experts surveyed, 17 specialized in Korean internal medicine, and 14 specialized in Korean gynecology. The mean age of the respondents was 43 and the gender split was 65% males to 35% females. Participant clinical experience were 6–10 years for 2 participants and more than 10 years for 29 participants. (Table 1).

**Table 1 – Demographic Characteristics of the Experts**

Variables		N	%
Gender (n = 31)	Male	20	64.5
	Female	11	35.5
Clinical career (n = 31)	6–10 years	2	6.3
	>10 years	29	90.6
Specialty (n = 31)	Korean internal medicine	17	54.8
	Korean gynecology	14	45.2

#### 3.2. Expert responses about CHHF

##### 3.2.1. Definition and diagnosis of CHHF

Regarding the diagnosis of CHHF and the tools used for diagnosis, 13 participants (41.9%) fully agreed with the definition of CHHF, 13 (41.9%) fairly agreed, and 5 (13.5%) disagreed. The equipment and parameters used for diagnosing or evaluating CHHF, in the order of frequency of use, were DITI, HRV, CST, thermometer, pulse wave velocity (PWV), nail fold capillary microscope, and red blood cell deformability. Subjective patient symptoms were preferred (24, 77.4%) to the results of diagnostic equipment (7, 22.5%) for evaluating CHHF. Additionally, 10 (32.2%) respondents agreed to calling a difference of 0.3°C between LU4 and PC8 a positive diagnosis of cold sensitivity in the hands and 10 (32.2%) agreed to calling a difference of 2.0°C between ST32 and LR3 a positive diagnosis of cold sensitivity in the feet<sup>8</sup> (Table 2).

**Table 2 – The Experts' Responses About CHHF**

Question theme		Opinion	N	%	
Concept	Agreement with the suggested definition.*	Agree	13	41.9	
		Almost agree	13	41.9	
		Do not agree	5	16.1	
	Does it need modification?†	Should consider cold temperature besides room temperature (3)			
		Should change 'become' to 'feel' (2)			
		Should change 'average people' to 'other part of body' (1)			
		Should change 'in the room temperature' to 'without regard of temperature' (1)			
Diagnosis	Do you agree with the previous diagnostic criterion‡ for CHHF?	Agree	10	32.2	
		Neutral	17	54.8	
		Do not agree	4	12.9	
	Could you suggest any reasons if you 'neutral' or 'do not agree'?‡	Subjective symptoms are more important (5)			
		The acupuncture points are too narrow to represent each relevant part of the body (2)			
		The suggested temperature difference is not verified yet (1)			
	Do you need diagnostic equipment on CHHF?	Yes		29	93.5
		No		2	6.5
	What kind of equipment are required if necessary?§	Digital infrared thermography imaging		29	93.5
		Heart rate variability		17	54.8
		Cold stress test		10	32.2
Thermometer			9	29.0	
Pulse wave velocity			8	25.8	
Nail fold capillary microscope			5	16.1	
Red blood cell deformability			4	12.9	
Monofilament test			1	3.2	
Which do you value more subjective symptoms or diagnostic equipment results?	Subjective symptoms		24	77.4	
	Diagnostic equipment results		7	22.6	
Causes and pattern identification	Main cause§	Constitution or genetic factor	27	87.1	
		Psychological stress	20	64.5	
		Lack of activity	12	38.7	
		Irregular lifestyle	11	35.5	
		Cold environment	5	16.1	
		Depression	4	12.9	
		Drugs	3	9.7	
		Cold foods	1	3.2	
		Overeating	1	3.2	
		Yang deficiency	17	54.8	
	Pattern identification§	Spleen–stomach deficiency cold	17	54.8	
		Kidney yang deficiency	6	19.4	
		Qi and blood deficiency	6	19.4	
		Liver qi stagnation	5	16.1	
		Blood deficiency and congealing cold	5	16.1	
		Blood stasis	2	6.4	
		Heart–kidney non-interaction	2	6.4	
Accompanying symptoms and disease	General symptoms§	Sensitive to cold	28	90.3	
		Fatigue	25	80.6	
		Dizziness	13	41.9	
		Ephidrosis in hands and feet	13	41.9	
		Insomnia	5	16.1	
	Digestive symptoms§	Swelling	3	9.6	
		Dyspepsia	20	64.5	
	Menstrual Symptoms§	Anorexia	14	45.2	
		Menstrual pain	27	87.1	
		Leucorrhea	16	51.6	
	Comorbidity (or underlying disease)§	Irregular menstruation	11	35.5	
		None	15	48.4	
		Raynaud's syndrome	15	48.4	
		Hypothyroidism	12	38.7	

– Table 2 (Continued)

Question theme	Opinion	N	%
	Hypotension	12	38.7
	Diabetic neuropathy	4	12.9
	Carpal tunnel syndrome	1	3.2
	Radiculopathy	1	3.2

The numbers in () mean N, which are stated opinions. CHHF: cold hypersensitivity in the hands and feet.

\* A feeling of cold as a symptom that one's hands or feet become colder than those of average people in temperatures that are not normally perceived as cold.

‡ Diagnostic criterion for 'cold hypersensitivity in the hands'  $\Delta LU4 > 0.3^\circ\text{C}$  in hands and diagnostic criterion for 'cold hypersensitivity in the feet'  $\Delta ST32-LR3 > 2^\circ\text{C}$  in feet.

† Short-answer question.

§ Multiple choice is possible.

### 3.2.2. Causes and pattern identification of CHHF

Physical constitution or genetic reasons (27, 87.1%) emerged as the most common etiological cause, followed by stress (20, 64.5%) and lack of exercise (12, 38.7%), respectively. For the identification of patterns related to CHHF, yang deficiency (17, 54.8%) was the most common, followed by spleen–stomach deficiency cold (17, 54.8%), kidney yang deficiency phlegm–fluid retention (6, 19.4%), and liver qi stagnation (6, 19.4%) (Table 2).

### 3.2.3. Symptoms and disease associated with CHHF

The most common physical symptoms associated with CHHF were sensitive to cold (28, 90.3%) and fatigue (20, 64.5%). In the digestive system, dyspepsia (20, 64.5%) and anorexia (14, 45.2%) were noted. Female patients were also reported to complain of menstrual pain (27, 87.1%), leucorrhea (16, 51.6%), and irregular menstruation (11, 35.5%). Disease comorbidity (or underlying disease) was most commonly a non-issue (no accompanying diseases (15, 48.4%)), followed by Raynaud's syndrome (15, 48.4%) and hypothyroidism (12, 38.7%) (Table 2).

## 4. Discussion

CHHF most commonly affects women of Asian ethnicity, including Koreans, and both of them compromise patient status and reduce quality of life. The prevalence of CHHF has not been researched in detail partly because of the ambiguity of its diagnostic criteria. Nevertheless, cold hypersensitivity was spread to affect 38.7% of 318 women in one survey.<sup>13</sup> In another study of 336 women with CHHF symptoms, 63.7% suffered from coldness in the feet and 59.5% suffered from coldness in the hands.<sup>14</sup> This fact suggested that the frequency of cold hypersensitivity was quite different among each study, which we thought to have come from concept and standard differentiation. Therefore, we researched this study to drag out experts' consensus about definition and diagnosis of CHHF.

In our results, 83.8% of experts agreed or almost agreed with this definition. In the present work, CHHF was defined as "a feeling of cold as a symptom that one's hands or feet become colder than those of average people in temperatures that are not normally perceived as cold." And then some of the experts need to additionally modify the stated definitions.

First of all, about temperature, three experts thought that 'in cold temperature' should be considered besides 'room temperature'. And one expert thought that temperature was regardless of CHHF. This could be thought that the excessive cold hypersensitivity at hands and feet should be perceived as an inadequate symptom regardless of temperature, which means the experts weighed cold hypersensitivity of hands and feet as autonomic nerve problem.<sup>15</sup> Next, about recovery, one expert suggested that there were no criteria regarding the recovery of CHHF symptom. There have been several studies evaluating recovery ability of peripheral temperature. And delay of recovery could make patients dysphoric. Therefore, we also agreed with this opinion about recovery ability and thought it should be considered when evaluating severity.<sup>6,16</sup>

Regarding further diagnosis standard, 32.2% of experts agreed with the definition that a temperature difference of  $0.3^\circ\text{C}$  between LU4 and PC8 indicates a diagnosis of cold hypersensitivity in the hands and that a difference of  $2^\circ\text{C}$  between ST32 and LR3 indicates a diagnosis of cold hypersensitivity in the feet.<sup>8</sup> When seeing three negative opinions, first of all, subjective symptoms are more important. It might be they thought because CHHF was not related with real temperature or equipment had limitation of measurement method or standard. But we could infer it as the latter one by judgment from the question result of medical equipment DITI necessity. In fact, criteria of latest CHHF clinical research include not only subjective symptoms but also evaluation of peripheral temperature.<sup>17,18</sup> Some studies, however, do not include it as a criterion and use it when evaluating improvement or severity.<sup>19</sup> And the difference of measurement point such as fingertip and palm could be a factor of disagreement.<sup>16–19</sup> Some experts claimed that it is more appropriate to examine the hands and feet as a whole, since patients complain of coldness either in the tips of fingers or in the palm of the hands. To overcome these limitations, DITI analysis should be improved to measure and compare temperatures anywhere of the body. Furthermore, efforts should be made to minimize environmental influences during the test; examination room humidity, temperature, and ventilation. And patient clothing and position should be also controlled and standardized. Indeed, a previous study by Takatori et al. demonstrated that a controlled environment improves the accuracy of patient thermography.<sup>20</sup>

This difficulty regarding skin temperature measurement as diagnosis standard or as severity evaluation needs Delphi study and depth interview including diagnosis, physiology, and pathology experts.

In the category of questions that asked about diagnostic equipment, 93.5% of experts agreed on the need for diagnostic equipment in the diagnosis of CHHF. However, 77.4% of clinicians also indicated that subjective symptoms were more important than result obtained from diagnostic equipment. As we stated, it needs additional discussion whether the results of diagnostic equipment are included to CHHF diagnosis or to severity evaluation. Also, a study, whether CHHF with peripheral temperature decline could better explain relation with specific disease or exacerbation of life quality than CHHF without peripheral temperature decline or not, is required.

In the cause topic, constitution or genetic factor, emotional stress, lack of activity were considered as major causes. This accords with results of existing studies such as study of relation between Sasang constitution and CHHF<sup>21</sup> and cold hypersensitivity study between twins.<sup>1</sup> But studies about emotional stress, lack of activity, irregular lifestyle, cold environment, and depression do not exist or partially support the result of our research. Further study seems to be required.

Consistent with these findings, commonly reported pattern identifications were yang deficiency, spleen–stomach deficiency cold, kidney yang deficiency, and liver qi stagnation. As cold is related with yang deficiency in Korean medicine, experts might mostly consider CHHF as yang deficiency related pattern identification. And also emotional stress is usually explained by qi stagnation in Korean medicine, as well as liver qi stagnation and heart–kidney non-interaction might be counted.<sup>22</sup>

On a final note, the survey result about comorbidities or underlying disease (where none (48.4%), Raynaud's syndrome (48.4%), and hypothyroidism (38.7%) were the most prevalent) does not indicate the dominant prevalence in CHHF. The relationship of CHHF with other diseases is controversial. However, given that the frequencies “none” and “Raynaud's syndrome” are the highest, most experts seem to recognize the cause of CHHF as idiopathic. This is similar to the fact that clinicians studying Flammer syndrome, which is known to be associated with CHHF, recognize the cause as primary vascular dysregulation. Perhaps a prospective clinical study of CHHF will give the answer.<sup>15,23</sup>

In conclusion, our data suggested that a more representative and standardized definition for CHHF and better tools for its diagnosis are urgently required. Importantly, our work does not represent the opinion of every KM doctor, although we did attempt to target the experts in this field. However, we did obtain a general consensus on the themes, opinions, and experiences of experts with CHHF in the present study. Future work is required to validate the expert opinions and develop a more clinically useful characterization of CHHF.

## Conflict of interest

The authors declare that they have no conflict of interest.

## Authors' contributions

YSJ, HYG and KHB conceived the study design and drew up the questionnaire. KHB and YSJ drafted the manuscript. HYG, YKC and YSL collected and analyzed the questionnaire data. SWL, KYJ, YKS, JHP, SHS and CYJ helped with the previous study and reviewed this manuscript. All of the authors contributed critically to the final manuscript and approved the final version.

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## Appendix I. Supplementary data.

Supplementary material related to this article can be found, in the online version, at [doi:10.1016/j.imr.2017.11.001](https://doi.org/10.1016/j.imr.2017.11.001).

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