

Research Article

Prevalence of Primary Palmar Hyperhidrosis and its Impact on Hand Grip Strength and Quality of Life

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Abstract

Background: Primary palmar hyperhidrosis is a disorder resulting in abnormally excessive sweating of palmar side of hand. Patients present with cold and wet hands. It can also occur in combination with other areas like soles, axillae, and craniofacial region.

Objective: To estimate prevalence of primary palmar hyperhidrosis in Faisalabad and its impact on hand grip strength and quality of life.

Methods: This analytical cross-sectional study was conducted at Dermatology departments of three tertiary care hospitals of Faisalabad, Pakistan. Sample size was calculated using formula. Both genders with age ranging from 15 to 65 years were selected as participants using convenient sampling. Participants filled self-made form which included demographics, screening and valid and reliable quality of life measuring tools (HDSS and Keller scale). Then, after screening, grip strengths of hyperhidrotics (group 1) and non-hyperhidrotics (group 2) were measured using modified sphygmomanometer test (cuff method) and were compared. Data were analyzed using SPSS version 22.

Results: Prevalence of primary palmar hyperhidrosis was 15.5% (11/71) consisting of 6 females and 5 males. Age of onset occurred during 5-15 years. 63.64% patients had positive family history. 90.91% patients had normal (18.5-24.9) BMI. Mean right and left grip strength values of hyperhidrotic patients were 168.55±55.446 and 157.55±44.568, respectively. Mean right and left grip strength values in non-hyperhidrotic participants were 157.63±53.126 and 148.67±53.85, respectively. 54.55% patients reported 3 on HDSS. On Keller scale majority reported mild to severe distress especially when shaking hands with others, writing papers, driving cars, grasping heavy objects, and wearing gloves.

Conclusion: Current study showed 15.5% prevalence rate of primary palmar hyperhidrosis. Hand grip strength values of hyperhidrotic patients were higher when compared with non-hyperhidrotic participants. Majority of patients reported barely tolerable sweating which resulted in mild to severe distress experienced during activities of daily living.

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Introduction

Primary palmar hyperhidrosis is a disorder resulting in abnormally excessive sweating of palmar side of hand. Patients present with cold and wet hands. It can also occur in combination with other areas like soles,



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axillae, and craniofacial region. Diagnostic criteria include visible localized excessive sweating occurring without apparent cause. At least 2 of these characteristics should be present: bilateral and symmetrical sweating, onset occurring before 25 years, presence of family history, absence of sweating during sleep, and impairment of daily activities.¹

Sweat centers in hypothalamus control sweating by activating sweat glands in skin and in case of hyperhidrosis hyperstimulation of normal sweat glands occur. Thermoregulatory sweating helps in heat dissipation from the whole body but is less evident on palms and soles.² On the other hand, emotional sweating also occurs all over the body but is most evident in palms and soles therefore helps in grip function. Emotional sweating is produced as physical sign in response to stimuli like stress, anxiety, fear, pain, focus, and attention. During grip function naturally small amount of sweat gets absorbed in stratum corneum i.e., outer layer of skin.^{2,3} This moistens and softens skin's ridges/fingerprints providing larger contact area with the object than dry skin. Larger surface area helps in increasing net friction to allow good grip while a person is running or climbing in stressful condition or is attentively performing activities like writing, hand crafting, driving, eating, etc. Increased sweat in hyperhidrosis reduces friction making object handling difficult. Eccrine glands are found all over the skin but majority are found in palms and soles. Therefore, palmar hyperhidrosis in most cases occurs in combination with plantar hyperhidrosis.³ Etiology of primary palmar hyperhidrosis is still understudy. But it can be classified as a genetic-hereditary trait, as a neurological dysfunction, as enzymatic or metabolic disorder, as an anatomical-histological change, or as a pathophysiological condition.⁴

Prevalence of palmar hyperhidrosis is 2.1% in Chinese adolescents whereas in other countries the range is 0.6% - 10.4%.⁵ Diagnosis for palmar hyperhidrosis can also be made using questionnaire which eliminates the need of physical examination. This questionnaire is called Keller hyperhidrosis scale and has strong correlation value of 0.723 when compared with peak sweat rates.⁶ Treatment options include topical antiperspirants, oral and topical anticholinergics, iontophoresis, botulinum toxin intradermal injection, surgical therapy, and high frequency ultrasound.⁷ Continuous sweating results in

poor quality of life by affecting psychosocial, occupational and personal domains of patient's life.⁸ According to recent case study palmar hyperhidrosis also results in fingerprint loss making use of fingerprint sensor and touch screens difficult.⁹

Skin friction is important for object handling but is affected by skin hydration, lubrication between contact surfaces, and material of object in contact. Friction increases for slightly moist skin but reduces for dry, greasy, wet or very wet skin. During grip-like contact slight sweat increases surface area of skin, provides thin layer of water between contacting surfaces for capillary adhesion, forms glue-like thin layer due to lipids and proteins in sweat. In case of hyperhidrosis skin is no longer moist, it becomes wet from moist to very wet reducing adhesion and thus friction.¹⁰ Zackrisson et al. (2008) measured the effect of excessive sweating on grip force using force sensors installed in objects. They discussed that excessive sweating reduces friction between contacting surfaces of skin and object which results in slight slipping of object. It is overcome by exerting extra grip force (safety margin) to hold object in air. Reduced sweating resulted decreased safety margin.¹¹ Grip strength can also be measured using sphygmomanometer by performing some alterations in tool. This tool is easily accessible, valid and reliable having positive and strong correlation values ranging from 0.90 to 0.97.^{12,13} Different researches have compared sphygmomanometer with other tools like dynamometers and different force systems and have found moderate to good relationship between them. Souza et al. compared sphygmomanometer with dynamometer and found good correlation between them.¹⁴ In a recent study O'Connor et al. compared sphygmomanometer with force frame system and found good to moderate relationship.¹⁵

Scarce literature was found about primary palmar hyperhidrosis and its impact on hand grip strength and quality of life in Pakistan. Therefore, rationale of this study was to estimate the prevalence of primary palmar hyperhidrosis and its impact on hand grip strength and quality of life.

Methods

This cross-sectional study was conducted to estimate prevalence of primary palmar hyperhidrosis in Faisalabad City of Pakistan and its impact on hand grip strength

and quality of life. Approval was taken from ethical committee of Faisal Institute of Health sciences, Faisalabad, Pakistan. Sample size was calculated using the following formula which is used for sample size calculation of cross-sectional studies :¹⁶

$$\text{Sample size} = \frac{Z_{1-\alpha/2} p(1-p)}{d^2}$$

$Z_{1-\alpha/2}$ is standard normal variate at 5% type 1 error ($p < 0.05$) which is 1.96 and “d” is absolute error or precision which is 0.05 (5%). “p” is prevalence rate used in previous studies or pilot study. In previous study the prevalence rate of palmar hyperhidrosis was 0.6%-10%, therefore, for current study “p” was taken as 10% because 0.6% would have given very less sample size.⁵ Calculated sample size after putting values in formula was 71.

Using convenient sampling technique participants with or without primary palmar hyperhidrosis were selected presenting at outpatient dermatology departments of Faisal hospital, Allied hospital, and District Head Quarter hospital, Faisalabad, Pakistan. Participants for this study were taken with age ranging between 15 to 65 years by taking into account a previous prevalence study.¹⁷

Participants excluded from this study were those having any underlying medical condition, those who had undergone thoracic sympathectomy, and those who disagreed to participate. Consent was taken from those who wanted to participate in the study. All participants were asked to fill a self-made form which included demographics, screening for primary palmar hyperhidrosis, and quality of life measuring tools. Disease specific tools like Hyperhidrosis disease severity scale (HDSS) and Keller hyperhidrosis scale were used to measure quality of life of patients. HDSS is a 4-itemed scale and are scored from 1 to 4 according to severity of condition. Items are: 1) sweating is never noticeable and never interferes with daily activities, 2) sweating is tolerable but sometimes interferes with daily activities, 3) sweating is barely tolerable and frequently interferes with daily activities, 4) sweating is intolerable and always interferes with daily activities. HDSS has “r” value ranging from 0.35-0.77 and Keller scale has Cronbach’s α value of 0.89.¹⁸ Participants were screened and diagnosed by the dermatologists and were divided into two groups (group 1 consisted of palmar hyperhidrotics and group 2 consisted of non-palmar hyperhidrotics) so that their

grip strengths could be compared.

Grip strengths of participants of both groups were measured by researchers using modified sphygmomanometer test (Cuff method).¹⁴ Cuff of sphygmomanometer was rolled into a cylindrical shape and was tied with tape. Then cuff was inflated till 20mmHg. After doing these alterations patient was asked to sit in chair with elbow resting on the table at 90 degrees and forearm in neutral position. Then the patient was asked to grip inflated cuff with maximum strength, hold it for 3-5s and then release it. Values were recorded bilaterally. 20 was subtracted from each measurement and final values were recorded. Then quality of life of hyperhidrotic patients was assessed using HDSS and Keller scale which were included in form.

Data were analyzed using SPSS version 22. Grip strength values were described in the form of mean \pm standard deviation. Prevalence, demographics, disease characteristics, HDSS and Keller scale scores were described in the form of frequencies.

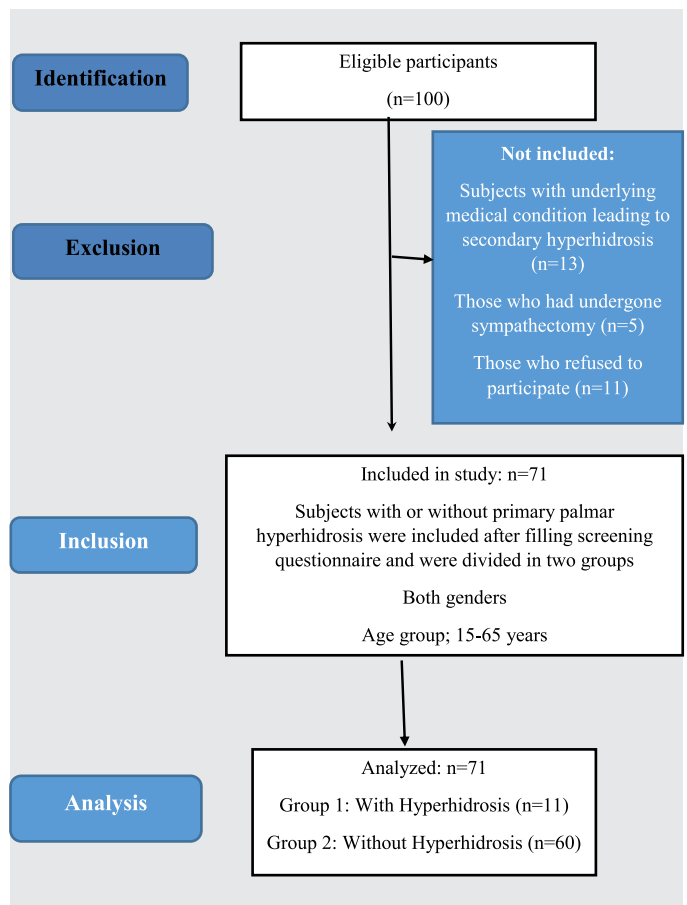


Figure 1: STROBE diagram showing all stages of study.

Results

This study included 71 participants. Out of these participants 11/71 (15.5%) were suffering with primary palmar hyperhidrosis (group 1) and 60/71 (84.5%) were not suffering with the disease (group 2). In group 1 presenting age of 10/11 patients was between 15-25 years and 1/11 patient was 26-35 years. 6 patients were females and 5 were males. Majority of the patients (10/11) were students and only (1/11) was self-employed. Majority (10/11) of patients had normal body mass index (BMI 18.5-24.9) and 1/11 was overweight (BMI 25-29.9). Group 2 consisted of 40 males (66.67%) and 20 females (33.33%). Majority of 35/60 participants were present in age group 15-25 years, 19/60 were in group 26-35 years, 3/60 in group 36-45 years, 2/60 in group 46-55 years and 1/60 in 56-65 years. 22(36.67%) participants were students, 20 (33.33%) were employed, 13 (22.67%) were self-employed and 5(8.33%) were unemployed. Only 1(1.67%) participant was underweight (BMI <18.5), 40 (66.67%) were of normal weight (BMI 18.5-24.9), 15 (25.00%) were overweight (BMI 25-29.9) and 4(6.67%) were obese (BMI 30-40).

Table 1 shows disease characteristics of hyperhidrotic patients. Age of onset in 9/11 patients occurred during 5-10 years of age and in 2/11 patients it occurred during 11-15 years of age. Positive family history was present in 63.64% patients. Bilateral sweating was present in all patients. Majority of patients (8/11) reported cessation of sweating during sleep. 6 patients had sweating confined to palms only, 4 had sweating on palms and soles, and only 1 patient had sweating on palms and soles and face. Maximum patients 6/11 reported 3 on HDSS, 3/11 reported 3, and 2/11 reported 4.

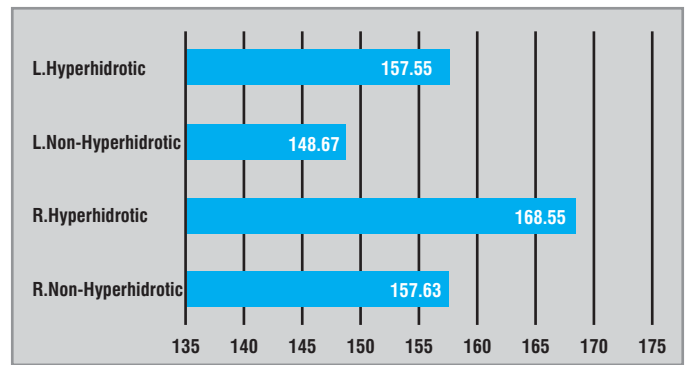


Figure 2. Grip Strength values of both hyperhidrotic and non-hyperhidrotic participants

Table 1: Disease Characteristics of Patients

Disease Characteristics Patients	f (%)
Prevalence	11/71 (15.5%)
Family History	
Positive	7 (63.64%)
Negative	4 (36.36%)
Age of Onset	
5-11 Years	9 (81.82%)
11-15 Years	2 (18.18%)
Bilateral Sweating	11 (100%)
Sweating During Sleep	
No	8 (72.73%)
Yes	3 (27.27%)
Difficulty using touch screens and fingerprint sensors	
Yes	10 (90.91%)
No	1 (9.09%)
Site of Sweating	
Palms Only	6 (54.55%)
Palms + Soles	4 (36.36%)
Palms + Soles + Face	1 (9.09%)
HDSS	
Grade 1	0 (0%)
Grade 2	3 (27.27%)
Grade 3	6 (54.55%)
Grade 4	2 (18.18%)

Table 2: Keller Hyperhidrosis Scale Scores

Keller Hyperhidrosis Scale	No distress (0)		Mild distress (1-3)		Moderate distress (4-6)		Severe distress (7-9)		Worst distress (10)	
	f	%	f	%	f	%	F	%	f	%
Shaking hands with others	0	0	1	9.1	4	36.4	5	45.5	1	9.1
Holding hands with spouse	11	100	0	0	0	0	0	0	0	0
Writing on documents	0	0	0	0	5	45.5	2	18.2	4	36.4
Grasping heavy objects or tools	0	0	3	27.3	3	27.3	5	45.5	0	0
Initiating intimate contact	11	100	0	0	0	0	0	0	0	0
Tuning knobs	1	9.1	6	54.5	4	36.4	0	0	0	0
Driving car	5	45.5	0	0	3	27.3	3	27.3	0	0
Eating with forks or spoons	1	9.1	8	72.7	2	18.2	0	0	0	0
Wearing gloves	0	0	0	0	7	63.6	3	27.3	1	9.1

Figure 2 represents mean of bilateral grip strength values of both groups. Right and left grip strength values of palmar hyperhidrotic patients were 168.55 ± 55.446 and 157.55 ± 44.568 , respectively. Right and left grip strength values of non-hyperhidrotic participants were 157.63 ± 53.126 and 148.67 ± 53.85 , respectively.

Table 2 shows values of Keller scale. Those suffering from hyperhidrosis filled this scale. On a scale of 0 to 10 majority of 5/11 patients reported a score of 7-9 for shaking hands with others, for writing papers majority of patients 5/11 reported a score of 4-6, for turning knobs majority of patients 6/11 scored 1-3, for driving cars 3 patients scored 4-6 and 3 reported 7-9, for grasping heavy objects majority of 5 patients reported a score of 7-9, and for wearing gloves majority scored 4-6.

Discussion

Prevalence of primary palmar hyperhidrosis estimated in this study was 15.5% (11/71). Previous researches performed in China reported lower prevalence rates than this for primary palmar hyperhidrosis.^{19,20}

In this study positive family history was present in majority of 7/11 (63.64%) patients which suggests that primary palmar hyperhidrosis most commonly occurs in those who are genetically predisposed to it. Westphal et al. (2011) reported positive family history in 50% cases, Lima et al. (2015) in 45% cases. Age of onset in this study in 9(80.82%) patients was 5-10 years while in 2 (18.18%) patients during 11-15 years. Fujimoto et al. (2013), Lai et al. (2015), and Liu et al. (2016) also reported similar results.^{20,23,24} Park et al. (2010) discussed that patients with positive family history have early age of onset at age of 13 and in patients without positive family age of onset occurs late at the age of 16.²⁵

In present study bilateral sweating occurred in 11/11 (100%) cases. Whestphal et al. (2011) also reported bilateral sweating in 100% cases whereas Lima et al. (2015) reported bilateral sweating in 75.76% patients.^{21,22} Primary palmar hyperhidrosis can also occur in combination with other areas and in this study 6/11 patients reported sweating confined to palms only, 4/11 patients reported combination of palmar sweating with soles and 1/11 patient reported palmar sweating in combination with soles and face. Similar finding was reported

by Tu et al. (2007) and Lai et al. (2015).^{19,20}

In current study impact of palmar hyperhidrosis on grip strength was evaluated by using modified sphygmomanometer test. Bilateral mean hand grip strength values of hyperhidrotic patients were higher when compared with grip strength values of non-hyperhidrotic participants. Higher grip strength values in hyperhidrotic patients were because of applying extra force while gripping cuff of sphygmomanometer. Zackrisson et al. (2008) showed similar results and discussed that hyperhidrotic patients have increased grip force because of increased sweating.¹¹

On HDSS 27.2% patients reported severity of 2, 54.55% patients reported 3, and 18.18% reported 4. Previous studies showed same findings.^{23,26} In contrast Park et al. (2010) showed that 87.9% patients reported 4 on HDSS.²⁵ Majority of patients reported a score ranging from 3 to 9 on Keller hyperhidrosis scale especially when shaking hands with others, writing papers, driving cars, grasping heavy objects, and wearing gloves. This finding was similar to previous studies.^{27,28}

Tools like dynamometers and specially designed force sensors were not used for grip strength measurement. Secondary palmar hyperhidrotic patients were not included for comparison. Another limitation of this study is that the prevalence rate was estimated in only one city therefore this rate can't be generalized to the whole country. For future research work on this topic, it is recommended to use dynamometers or force sensors for calculation of grip strength, also to include secondary hyperhidrotic patients and to estimate prevalence on national level.

Conclusion

In current study 15.5% prevalence was estimated for primary palmar hyperhidrosis which is relatively higher than previous studies. Hand grip strength values of hyperhidrotic patients were higher when compared with non-hyperhidrotic participants. Scores reported by patients on HDSS and Keller scale showed that hyperhidrosis has negatively impacted their quality of life. Majority of patients reported barely tolerable sweating which resulted in mild to severe distress experienced during activities of daily living.

Ethical Approval: Given

Conflict of Interest: The authors declare no conflict of interest.

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