Red Eccrine Chromhidrosis with Review of Literature

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Abstract
A 22-year-old male presented with reddish discoloration of the vest following perspiration for 6 months. He was a habituated consumer of cranberry juice. The peak absorption on spectrophotometric analysis of the extracted sweat coincided approximately with the peak absorption of diluted distillate of the juice. A diagnosis of eccrine chromhidrosis, probably due to the coloring agents in the juice, was considered. This rare case report emphasizes the possible side effect of the various coloring agents used as food additives.

Key Words: Cranberry juice, eccrine chromhidrosis, food additives, red sweat

Introduction
Chromhidrosis is a rare condition characterized by secretion of colored sweat from eccrine and apocrine glands.[1] Being exogenous in origin, eccrine chromhidrosis is seldom encountered. Herein, we present a curious case of eccrine chromhidrosis, depicting the toxicity of the various dyes used as coloring agents as food additives in the present era.

Case Report
A 22-year-old male, software engineer by profession, approached with a concern of reddish discoloration of his vest, shirt, and handkerchief on wiping his face, following perspiration for the past 6 months. The sweat was odorless and disappeared on washing the clothes. The patient denied any history of intake of drugs such as quinines or vitamin supplements or contact with any red-colored products such as dyes, paints, or colored clothes, leading to discoloration of vest. There was no history suggestive of bleeding diathesis.

The patient was examined after 10 min of exercise, using a new inner vest. The sweat which appeared showed a slight pinkish tinge. Later, cotton gauze was taken and the sweat was wiped from the patient’s forehead, which showed reddish discoloration of the swab [Figure 1]. The patient’s vests were also stained red. Rest of the cutaneous examination was normal. On soaking the cotton swab in the distilled water, a shade of pink was appreciated [Figure 2]. No fluorescence was noted on Wood’s lamp examination of the vest, skin, and the extracted sweat. General and systemic examinations were normal.

A differential of apocrine, eccrine, pseudo-eccrine chromhidrosis, and dermatitis-simulated hematohidrosis was considered and evaluated accordingly. Routine hematogram, coagulation profile, and liver function tests were within normal limits. No red blood cells (RBCs) were seen in the smear taken from the sweat. Culture of the skin swab revealed coagulase-negative staphylococci. Fungal culture had no growth. Histological evaluation of the skin biopsy from the face and trunk using hematoxylin-eosin stain and periodic acid–Schiff (PAS) stain revealed normal eccrine and apocrine glands [Figure 3]. No RBCs were seen in the eccrine gland lumen. Mid-stream urine collected in a glass container showed no red discoloration immediately and after 6 h of exposure to room temperature.

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In the view of generalized sweating with no periodic acid–Schiff-positive granules in the acinar apocrine cells and RBCs in the ductal lumen of eccrine glands on biopsy and negative culture, we ruled out the possibilities of apocrine chromhidrosis, pseudo-eccrine chromhidrosis, and hematohidrosis. A possible eccrine route was considered for the chromhidrosis. Keeping in view that true eccrine chromhidrosis is due to the excretion of water-soluble dyes from the eccrine glands, a follow-up, in-depth history about the intake of any food products with coloring agents was taken. At this stage, the patient admitted of drinking cranberry juice of a particular brand daily for the past 6 months following an episode of urinary tract infection, apparently advised by his friend. According to him, about 200 ml of the juice was consumed daily. With this history, the extracted sweat in the distilled water was subjected to absorbance spectrophotometry, which showed an absorbance at 290 nm. Subsequently, a stock solution of the juice was prepared by adding 5 ml to distilled water, and then diluted to 250 ml. Spectrophotometric evaluation of this stock solution produced a peak absorption at 305 nm, almost similar to the absorption of the extracted sample from the cotton swab. Hence, a provisional diagnosis of eccrine chromhidrosis was considered, probably due to the continuous use of the cranberry juice containing a water-soluble agent excreted through integumentary system.

To substantiate our diagnosis, elimination trial workup was done, where we asked the patient to stop consuming the cranberry juice and also advised to avoid using foods containing red colorants during this period. On reviewing the patient after 10 days, the reddish discoloration of the vests on perspiration was absent. On reintroduction of the juice, the red-colored sweat reappeared, thereby confirming the diagnosis of eccrine chromhidrosis. Mass spectrometry (MS) would have helped in identifying the exact agent, but it was not done, as the facilities were not available.

**Discussion**

Chromhidrosis (ephydrosis tincta) or secretion of colored sweat[2] is a very rare condition causing significant embarrassment among the patients. Three subtypes have been described by Cilliers and de Beer: true eccrine chromhidrosis, pseudo-eccrine chromhidrosis, and apocrine chromhidrosis.[3] Apocrine chromhidrosis is seen after puberty, usually confined to face and axilla, rarely areola. It is often noticed by patients as yellow, blue, green, and blue-black staining of the underclothing, which depends on the level of oxidation of the lipofuscin granules in the apocrine glands. Tyrosine, melanin, and heme breakdown products are also implicated as the color-producing molecules.[2] Under light microscopy using hematoxylin-eosin staining, yellow-brown lipofuscin granules may be present and autofluorescence may be noted at 360 nm in nonstained paraffin-embedded sections, skin, and stained clothes.[3]

Pseudo-eccrine chromhidrosis occurs when the colorless sweat gets colored on reaching the skin on reaction
with exogenous chromogenic bacterial products such as Corynebacterium, piedraia, bacillus species, chemicals, paints, and dyes.[4]

True eccrine chromhidrosis is a less common generalized disorder mostly caused by coloring of the clear eccrine sweat by dyes, pigments, or metals.[1] Hurley and Wilkowski found that dyes from quinine and imine groups are readily excreted by eccrine glands in a sufficient concentration to be readily visualized.[6]

There is a paucity of data regarding the eccrine chromhidrosis in medical literature. The cases of eccrine chromhidrosis to the best of our knowledge reported till date are summarized in Table 1.

As per the available literature, the causes of eccrine chromhidrosis can be classified as follows:

1. Exogenous: Due to ingestion of the drugs containing quinines,[1] dyes such as tartrazine,[10] coloring/flavoring agents present in food products,[1] and heavy metals such as copper[2,13]

2. Endogenous: Due to hyperbilirubinemia associated with liver disorders. Patients present with greenish discoloration of palms and soles with or without pompholyx-like lesions. The brown-colored water-soluble direct bilirubin is said to be secreted through the eccrine glands and converted into green-colored biliverdin by an oxidative process and hence giving rise to green-colored sweat.[6,11,12]

Our patient is a case of eccrine chromhidrosis, possibly due to excretion of red dye present in the cranberry juice into the integumentary system. A temporal relation of disappearance and reappearance of the red sweat on elimination and reintroduction of the juice during the trial workup confirms our diagnosis. A similar case was reported by Gilliers and de Beer, in which the red-colored staining of the underclothing was attributed to the coloring agent present in a tomato snack, for which the patient was a fetish.[3]

Cranberry juice is a nonantibiotic alternative used for preventing urinary tract infections prescribed especially to sexually active adult women with recurrent urinary tract infections and elderly patients.[14] In the commercially available preparations of cranberry juice, apart from the naturally available anthocyanin pigment in the cranberries, red azo dyes are used to impart the red color to the drink.[15] These dyes are water soluble and this property is a prerequisite for their excretion in the eccrine sweat.[5,10] Hence, the reddish discoloration of sweat in our case may be due to the excretion of the unchanged dye (anthocyanin and azo dye) present in the juice into the eccrine glands. Whether the discoloration is due to anthocyanin or red azo dye and also the selective excretion of the dye only in the eccrine glands cannot be explained.

MS, which is an analytical technique used for determining the elemental composition of samples, quantifying the mass of particles and molecules, and elucidating the chemical structure of molecules, would have helped in identifying the exact agent responsible for the chromhidrosis.[14]

The highlights of the present case are – (a) The rarity of the condition. (b) eccrine chromhidrosis secondary to colorants in the cranberry juice, which to the best of our knowledge has not been reported so far. This report also indicates the complex side effect of the commercially available health drinks, since it has become more of a habit to consume these among people.

Table 1: Literature review of eccrine chromhidrosis

| Author               | Year | Complaints                          | Color of sweat | Proposed etiology                                           |
|----------------------|------|-------------------------------------|----------------|-------------------------------------------------------------|
| Kawakami and Hidano[5] | 1987 | Punctate greenish macules           | Green          | Hyperbilirubinemia, water-soluble bilirubin converted into biliverdin |
| Kanzaki and Tsuda[7]  | 1992 | Greenish pigmentation of palms and soles with pompholyx | Green          | Hyperbilirubinemia, water-soluble bilirubin converted into biliverdin |
| Allegue et al.[8]     | 1996 | Localized green pigmentation        | Green          | Hyperbilirubinemia, water-soluble bilirubin converted into biliverdin |
| Gilliers and de Beer[9] | 1999 | Staining of uniform and lingerie and soles with pompholyx | Red            | Red coloring agent in prepacked tomato snack                 |
| Lee et al.[9]         | 2010 | Pompholyx with green-colored vesicle on palms | Green          | Hyperbilirubinemia, water-soluble bilirubin converted into biliverdin |
| Krishnaram et al.[10] | 2012 | Yellow stain of underclothes        | Yellow         | Tartrazine, a yellow azo dye in Bisacodyl tablets             |
| Triwongwaranat et al.[11] | 2013 | Acral green pigmentation            | Green          | Hyperbilirubinemia, water-soluble bilirubin converted into biliverdin |
| Keum et al.[12]       | 2015 | Pompholyx with greenish pigmentation of palms and soles | Green          | Hyperbilirubinemia, water-soluble bilirubin converted into biliverdin |
| Ghosh et al.[13]      | 2015 | Blue green pigmentation of upper and lower limbs | Green          | Consumption of high copper-containing homeopathic medicine   |
| Present case          | 2016 | Red staining of vests               | Red            | Coloring agents present in cranberry juice                   |
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Conflicts of interest
There are no conflicts of interest.

What is new?
Eccrine chromhidrosis following the use of cranberry juice, a health drink commonly used by people for recurrent urinary tract infections

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