ADULTERATION OF GHANAIAN TOPICAL HERBAL PREPARATIONS WITH DEXAMETHASONE

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ABSTRACT

The aim of the study was to evaluate topical herbal preparations available on the Ghanaian market for the presence of the allopathic topical corticosteroid, dexamethasone. Sixteen herbal topical cream and ointment preparations were sampled and analysed by HPLC for dexamethasone. Seven of the sixteen samples 7/16 (43.75 %) contained dexamethasone at a mean concentration of 654 µg/g (range: 79-1200 µg/g) but the rest of the samples 9/16 (56.25 %) did not contain dexamethasone. The highest amount of dexamethasone was found in THP5 (1200 µg/g) while the lowest was detected in THP12 (79 µg/g). The herbal ingredients in four of the samples 4/16 (25 %) were absent from the product labels. Eight of the topical herbal preparations (50 %) were registered with the statutory medicines regulatory authority in Ghana while the remaining eight samples were unregistered. The study has shown that dexamethasone is increasingly being used fraudulently as an adulterant of topical herbal preparations to boost the therapeutic activity of such preparations. There is the need for enhanced control, monitoring and regulation by the medicines regulatory authorities in Ghana and other Sub-Saharan African countries to stem this growing menace.

Keywords: Dexamethasone, topical herbal preparations, adulteration, topical corticosteroids.
INTRODUCTION
Herbal remedies are commonly used in Ghana and other African countries for the management and treatment of various ailments. The popularity of herbal remedies in Africa can be attributed to its abundance, accessibility, and relative inexpensiveness compared to orthodox medicines. There is the general perception that herbal remedies are safe to use, harmless and are devoid of any adverse side effects. Herbal remedies are linked to the cultural and traditional religious practices of the African people (Snyman et al, 2005) who therefore perceive the practice as their heritage and consider it as their own. Herbal remedies can, however, induce serious adverse side effects such as allergic contact dermatitis, phototoxic reactions, contact urticaria, angiodema and anaphylaxis (Bayerl and Jung, 1996; Mullins, 1998; Asero et al., 1998; Foti et al., 1997; Kiken and Cohen, 2002).

Topical remedies and cosmetics based on herbal ingredients are particularly popular and abundant in Africa as they are deemed to be safer and healthier than their synthetic counterparts (Corazza et al., 2009). In Italy, a study involving 400 patients showed that 241 (60.3 %) of them used natural topical products, mainly aloe, marigold, chamomile, propolis and arnica (Corazza et al., 2009) and in the USA, about 8.6 % of people who use unconventional drugs did so to treat dermatological problems (Ernst, 2000). Also, even among herbal remedies, topical remedies are generally seen as safer products without any adverse side effects compared to oral remedies. In spite of the perception that topical herbal preparations are safer and free of adverse reactions, they are known to cause adverse reactions such as anaphylaxis (paprika), exudative erythema (rosewood), itching skin (aloe vera) and contact dermatitis (numerous herbal remedies) and photosensitization (Ernst, 2000). The worrying phenomenon of adulteration or contamination of herbal remedies with powerful synthetic drugs such as corticosteroids has been reported in various countries. An analysis of eleven (11) Chinese herbal creams applied to areas of sensitive skin such as face and flexures obtained from patients attending general and paediatric dermatology outpatient clinics in the UK showed that eight (8) creams contained dexamethasone at a mean concentration of 456 µg/g (range 64 to 1500 µg/g) (Keane et al., 1999). Another study in the UK showed that ‘herbal creams’ for treating childhood atopic eczema contained clobetasol propionate, clobetasol butyrate, betamethasone valerate and hydrocortisone (Ramsay et. al., 2003). A screening of 120 samples of alternative medicines dispensed to patients in India suffering from asthma, arthritis, etc, showed that 38.3 % of them were adulterated with steroids (Gupta et al., 2000). Also, herbal slimming remedies tested in United Arab Emirates...
were found to contain two anti-slimming orthodox drugs sibutramine hydrochloride and rimonabant hydrochloride (Kanan et al., 2009).

Even though there are very few reported cases from Africa concerning the adulteration of herbal remedies with orthodox medicines, a study in South Africa reported two cases where herbal remedies used by patients on admission to hospital were adulterated with the synthetic medicines trimethadione, propofol and diclofenac (Synman et al., 2005). Also, active pharmaceutical ingredients were found in 39 or 51 % of the 76 traditional herbal remedies in a study conducted in 20 major towns of Ethiopia using a validated analytical laboratory method (Debella et al., 2008).

The aim of the current study was to determine the possible adulteration of some popular and effective Ghanaian topical herbal remedies with the corticosteroid, dexamethasone. This is because corticosteroids are the most important adulterants of herbal creams (Ernst, 2002). Also, dexamethasone being the cheapest of the topical corticosteroids is commonly used to adulterate topical herbal preparations.

MATERIALS AND METHODS

MATERIALS

Pure micronized dexamethasone was a gift sample from Kinapahrma Ltd., Ghana. Sulphuric acid, hexane, methanol, deionised water were used as obtained.

Sample selection

Sixteen (16) brands of topical preparations, mainly creams and ointments, manufactured and marketed in Ghana and described by the manufacturers as being of herbal origin, were purchased from Pharmacies and Chemical shops in Kumasi, Ghana. The products selected were popular and well patronized among the Ghanaian populace and were generally considered to be effective in the treatment and management of various dermatological conditions. All the samples were at least six (6) months before the labeled expiry date. All the products were freely sold to patients in community pharmacies and licensed chemical shops in Ghana without prescription.

HPLC assay of topical preparations

An accurately weighed amount of a herbal topical preparation was transferred into a 100 ml beaker and mixed with 12 ml hexane on a water bath until it melted. The mixture was
transferred into a separating funnel and extracted separately with 20 ml methanol, followed by 10 ml methanol and then 10 ml of methanol and water (60:40). The extracts were combined and allowed to cool. The dexamethasone content of the extracts was determined quantitatively by HPLC using a 250 mm x 4.6 mm octadecylsilane column. The test conditions were: mobile phase – methanol: water (60: 40), loop size – 20 µl; flow rate – 1.5 ml/min, wavelength – 254 nm. The amount of dexamethasone in each topical preparation was determined using a calibration curve of pure dexamethasone in methanol: water (60:40) (y = 66490x -25.32, $R^2 =0.999$).

RESULTS

The topical herbal preparations sampled were indicated for various skin infections such as pimples, boils, itching, ringworm, shingles and eczema (Table 1). All were non-prescription preparations which were readily dispensed to patients on demand. The herbal ingredients in most of the preparations were given except for three (THP1, THP12, THP13) while the content of another (THP9) was just given as ‘Wonder powder’. Eight of the preparations (50%) were registered with the Food and Drugs Authority, Ghana, while the remaining eight (50%) were unregistered. Seven of the sixteen samples 7/16 (43.75 %) contained dexamethasone with a mean concentration of 654 µg/g (range: 79 to 1200 µg/g) while the remaining samples 9/16 (56.25 %) were free of dexamethasone. For the samples which tested positive for dexamethasone, the highest concentration of dexamethasone was found in THP5 (12000 µg/g) while the lowest was detected in THP12 (79 µg/g).

Table 1: Properties and dexamethasone content of topical herbal preparations sampled in Ghana

<table>
<thead>
<tr>
<th>Topical product code</th>
<th>Labeled herbal ingredients</th>
<th>Indications</th>
<th>Registration status*</th>
<th>Dexamethasone content (µg/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>THP1</td>
<td>NI</td>
<td>Most skin diseases</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>THP2</td>
<td><em>Alchorhnia cordifolia</em></td>
<td>Ringworms, yaws, shingles</td>
<td>Yes</td>
<td>0</td>
</tr>
<tr>
<td>THP3</td>
<td><em>Mallotus oppositifolium, Jatropha,</em></td>
<td>Boils, pimples, rheumatism</td>
<td>Yes</td>
<td>0</td>
</tr>
<tr>
<td>THP4</td>
<td>Cassia alata, Funtumia elastica,</td>
<td>Shingles, ringworms, boils, eczema</td>
<td>Yes</td>
<td>0</td>
</tr>
<tr>
<td>THP5</td>
<td>Carica papaya, Cassia alata, Cashew, Alchonia</td>
<td>Face spots, razor bumps, eczema, boils</td>
<td>Yes</td>
<td>1200</td>
</tr>
<tr>
<td>THP6</td>
<td>Daniellia ogea, Khaya ivorensis, cordifolia, Aloe vera</td>
<td>Boils, dandruff, ringworm, eczema, body itching</td>
<td>No</td>
<td>111</td>
</tr>
<tr>
<td>--------</td>
<td>--------------------------------------------------------</td>
<td>-------------------------------------------------</td>
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</tr>
<tr>
<td>THP7</td>
<td>Spathodea campanulata, Mallotus oppositifolium, Bombax buono-pozone, Erythrina mildbraedii</td>
<td>Piles, foot rot, pimples, ringworm, boils</td>
<td>Yes</td>
<td>753</td>
</tr>
<tr>
<td>THP8</td>
<td>Zingiber officinale, Capsicum frutescens, Zea mays, Piper spp., Bombax buono-pozone, Erythrina mildbraedii</td>
<td>Body pains, rheumatism, waist pain,</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>THP9</td>
<td>‘Wonder powder’ Zingiber officinale, Capsicum frutescens, Zea mays, Piper spp., Bombax buono-pozone, Erythrina mildbraedii</td>
<td>Pimples, measles, chicken pox, foot rot, sores, burns, boils, skin rashes</td>
<td>No</td>
<td>821</td>
</tr>
<tr>
<td>THP10</td>
<td>Elaeis guineensis, Raphia hookeri, Securidaca longipedunculata, Zingiber officinale, Mangifera indica, Pachypodium standii, Piper guineensis</td>
<td>Boils, waist pain, foot rot, rheumatism, rashes</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>THP11</td>
<td>Aloe vera, Musa spp., Hibiscus esculentus</td>
<td>Piles, skin rashes, sores</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>THP12</td>
<td>NI</td>
<td>Skin diseases like boils, ringworm, rashes, pimples</td>
<td>No</td>
<td>79</td>
</tr>
<tr>
<td>THP13</td>
<td>NI</td>
<td>Body pains, burns, itching, boils</td>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>THP14</td>
<td>Cleistopholis patens, Cinnamomum zeylanicum, Mentha piperita, Eucalyptus globules</td>
<td>Arthritis, sprains, rheumatism, lumbago, urticaria, boils, eczema</td>
<td>Yes</td>
<td>0</td>
</tr>
<tr>
<td>THP15</td>
<td>Alchornea cordifolia, Cassia alata, Terminalia superba, Aloe vera,</td>
<td>Hair growth promotion, treats most skin diseases</td>
<td>Yes</td>
<td>658</td>
</tr>
<tr>
<td>THP16</td>
<td>Alchornea cordifolia, Cassia alata, ‘Guto’ Terminalia superba, Aloe vera,</td>
<td>Treats ringworm, Foot rot, eczema, razor bumps, shingles</td>
<td>Yes</td>
<td>956</td>
</tr>
</tbody>
</table>

NI = not indicated

*Registered with the Food and Drugs Authority (FDA), Ghana
DISCUSSION

The use of topical herbal preparations is a common practice among Ghanaians due to their perceived efficacy, perceived lack of adverse side effects and the poor regulation of herbal products advertisement in the media. A number of the herbal preparations had been registered with the Food and Drugs Authority, the medicines regulatory authority in Ghana, which also gave users some assurance of their efficacy and safety. However, the presence of unregistered topical herbal preparations on the Ghanaian market is worrying. There is the need for the medicines regulatory authority to control the herbal medicines market very well with the view to weeding out the spurious and unregistered preparations from the market. Most of the topical preparations attributed the efficacy of their products to the herbal ingredients which are sold to the unsuspecting public as pure herbal preparations. Dexamethasone is a synthetic drug and is not a constituent or by-product of any medicinal plant. The presence of the corticosteroid, dexamethasone, in the preparations could therefore be the result of a deliberate attempt to adulterate the preparations with this allopathic drug to boost their efficacy. The concentration of topical corticosteroids in orthodox topical preparations is generally about 0.01-1%. However, some of the herbal preparations contained far in excess of the maximum recommended concentration of corticosteroids in topical preparations.

The inappropriate and indiscriminate use of corticosteroids may cause severe adverse reactions in patients which are exacerbated when these potent drugs are applied to areas of thin skin such as the face and flexures (Keane et al., 1999). The misuse or long term use of corticosteroids may cause severe relapse of the disease after treatment withdrawal, slow wound healing, masking of infections, irreversible skin atrophy, diabetes, truncal obesity, hypertension, osteoporosis growth retardation and suppression of the hypothalamic-pituitary-adrenal axis (Borzvkowski et al, 1976; Turpeinen, 1989; Gupta et al., 2000).

The quality assurance of topical herbal preparations should be enhanced as a matter of urgency to reduce possible accidental contamination of the products with corticosteroids and other potent allopathic medicines. In this regard, there is the need for the training of herbal practitioners to acquire the requisite knowledge and skills needed in herbal products formulation and preparation. Also, the licensing of herbal practitioners should be streamlined and enforced to weed out the charlatans. The licensing of herbal products can be enforced through capacity enhancement of the drug regulatory agencies in Ghana and Africa as a whole.
CONCLUSION
Some Ghanaian topical herbal preparations were found to be adulterated with the corticosteroid, dexamethasone, ostensibly to increase the efficacy of such preparations. There is the need for the medicines regulatory authorities in Ghana and other African countries to enhance their control and surveillance activities to eliminate this gross abuse of herbal preparations.

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