

Research Article

Is the Antimicrobial Peptide (Psoriasin) Absent in Palms of Nigerian Residents?

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Abstract

Psoriasin (S100A7) an antimicrobial peptide was associated with inhibition of *Escherichia coli* on palms but the role of geographical and racial differences were not implicated. 16 adult participants including 8 Nigerians and 8 permanent resident Philipinos/Indians who had lived in Okada, Edo State of Nigeria for at least 5 years were recruited. All the participants were requested to practised healthy hand hygiene (hand washing with hibiscrub and drying with paper towel) before inoculation. Their right and left hands were inoculated with *E. coli* and *Staphylococcus aureus* isolates (from neonatal orifices) respectively and covered with sterile gloves for 60 minutes to allow establishment of inoculum. The gloves were removed aseptically; the hands were inoculated on nutrient agar and incubated at 37 °C for 48 hours. The Gram staining and biochemical tests were carried out on the colonies formed on both hands to identify organisms in the colonies. The Gram staining on all the participants (Nigerians, Indians/Philipinos) right hands colonies formed showed Gram negative rod and the biochemical tests (oxidase, catalase etc) on these confirmed *E. coli*. The study concluded that psoriasin (antimicrobial peptide) that was documented to inhibit *E. coli* on hand might be absent in permanent residents in Nigeria irrespective of their races and there is need for further study with large population.

Keywords: Psoriasis, *E.coli*, Racial differences, Nigerians

INTRODUCTION

Innate immune system reduced infection that would have been major problem to humanity. The skin as a major organ and component of innate immune system provides structural, cellular and humoral protection against infectious organisms (Abtin *et al* 2008). The skin as the largest organ in the body with surface mass of 400m² provides the structural barrier between internal (body) and external environment (Belvins 2005). The antimicrobial effect of secretions from the skin provides effective humoral innate immunity. There are many secretions of the skin depending on the location but sweat gland, sebum and antimicrobial peptides are common (Braff and Gallo 2006). It was documented that psoriasin, an antimicrobial peptide is present in skin especially the hand (Braff and Gallo 2006; Eckert and Lee 2006). The antimicrobial effect of psoriasin has been noted to be more pronounced on *Escherichia coli* when compared with *Staphylococcus aureus* (Glaser *et al* 2005).

Psoriasin is one of the peptides secreted by keratinocytes and other epithelial cells in the body (Schroder 2010; Zwicker *et al* 2012). It is a member of S100 gene family with the code S100A7. Psoriasin is coded on short arm of chromosome 1 and it is calcium binding protein. It has been shown that interleukin-22 regulates the expression of genes that code psoriasin (Wolk *et al* 2006). Psoriasin interacts with

epidermal fatty acid binding protein in the skin to provide antimicrobial effect. Its antimicrobial effects have been reported on viruses, fungi and bacteria where it inhibited the growth of *Escherichia coli* (Belvins 2005; Fritz *et al* 2012). Psoriasin was also documented as chemotactic factor on neutrophils, macrophages and dendritic cells (Jinquan *et al* 1996). The chemo-attractant function of psoriasin might account for its role in inflammatory diseases of the skin (Belvins 2005).

Although psoriasin was initially associated with psoriasis, it is now linked with many diseases including inflammatory and neoplastic disorders (Wastson *et al* 1998). It has been postulated that deficiency of psoriasin may be advantageous because of its association with inflammatory skin diseases especially psoriasis (Harder and Schroder 2005). Thus psoriasin is a useful diagnostic and prognostic marker of psoriasis (Anderson *et al*, 2009; Glaser *et al* 2009). This means that excess concentration of psoriasin in the skin may predispose individual to disease.

Likewise, the deficiency of psoriasin in skin may not protect individual from infective agents like *Escherichia coli*. Virulent *Escherichia coli* may cause gastroenteritis, urinary tract infection, meningitis, haemolytic uremic syndrome, peritonitis, mastitis, pneumonia or severe septicaemia. Since psoriasin is a component of humoral innate immunity, its deficiency or impairment in function in neonates will predispose to infection (Glaser *et al* 2011; Porre *et al* 2005). This may be as a result of deficiency in function of psoriasin as antimicrobial peptide at epidermal surface and immunomodulatory properties at the dermal region if eventually the

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organism penetrated the skin (Kruse and Kristensen 2008; Zheng *et al* 2008).

Psoriasin was reported to be present in-utero human skin (Yoshio *et al* 2003). The deficiency in function can be genetic in origin which can be as a result of defective gene on chromosome. Psoriasin function can also be inhibited if there is deficiency of the dermal region binding protein. Atmospheric temperature may influence the function of the skin antimicrobial peptides. As calcium binding protein that is produced by keratinocytes, psoriasin is affected by vitamin D, thus sunlight exposure will influence the activity of this skin protein (Hegyí *et al* 2012; Peric *et al* 2009).

Geographical location and racial differences had influence on immunity and diseases. There are many diseases especially infectious origin that commoner in Sub-Saharan Africa than other geographical locations in the world. *Escherichia coli* have been implicated in many diseases. The presence of antimicrobial peptide (psoriasin) in skin will inhibit progression of normal bacterial flora to infection especially during immuno-suppression. Thus, deficiency of psoriasin in skin will predispose the individual to bacterial infection that would have been inhibited by the antimicrobial peptide (Holland *et al* 2009). Therefore, there is need to determine the psoriasin activity on *Escherichia coli* in permanent residents in Okada, Edo State of Nigeria

MATERIALS AND METHODS

Study location

The study was carried out in Okada, the headquarters of Ovia North-East Local Government of Edo State of Nigeria.

Study participants

There were 16 permanent residents in Nigeria that participated in this study. All the participants had lived continuously for at least five years in Nigeria

Biological medium: Nutrient agar

Organisms: *Staphylococcus aureus* and *Escherichia coli* isolates from neonatal orifices

Gram staining reagents

Reagents for the following biochemical tests: catalase, oxidase, citrate, indole, nitrate, methyl red, phenylalanine, motility, urease and lysine

Method

The procedure was carried out in the sterilised laboratory room temperature of 32°C as described by Glaser *et al* 2005. The two hands were washed with hibiscrub lotion and dried with sterilised paper towel through the normal procedure of hand hygiene (Onifade *et al* 2012). All the fingers of right and left hands were inoculated with *Staphylococcus aureus* and *Escherichia coli* isolates respectively. Both hands were covered with sterilised surgical gloves to avoid contamination from the surroundings for 60 mins. The inoculated finger tips were inoculated on freshly prepared nutrient agar plates separately and incubated for 48 hours at 37°C. Gram staining was done on all the colonies formed from both right and left hands. The following biochemical tests (catalase, oxidase, citrate, indole, nitrate, methyl red,

phenylalanine, motility, urease and lysine) were also done on the colonies formed from left hand as described by manual of Sigma-Aldrich Company

RESULTS

Participants Profile

The 16 participants were of equal sex distribution and nationalities i.e. 8 males and 8 females, 8 Nigerians and 8 foreigners respectively. The foreigners are Indians (4: 2 males and 2 females) and Phillipinos (4: 2males and 2 females). The 8 Nigerians were 4 albinos (2 males and 2 females) and 4 normal coloured skin (dark and light). This is illustrated in Figure I.

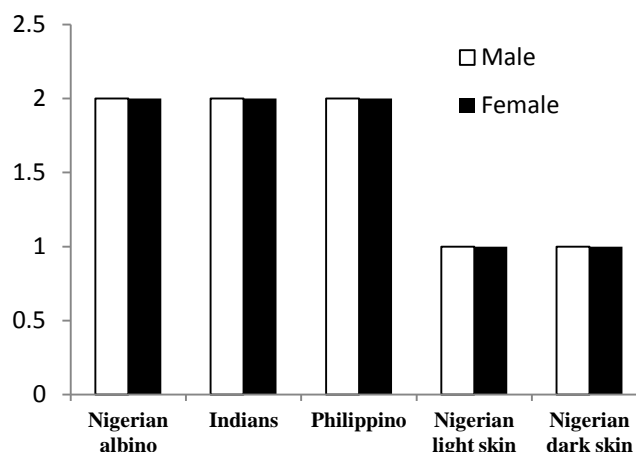


Figure 1

Bio-data (profile) of the study participants (number)

Table 1

Biochemical tests done on left hand colonies inoculated with *E. coli*

TEST	RESULT (positive or negative)
Catalase test	Positive
Oxidase test	Negative
Citrate test	Negative
Indole test	Positive
Phenylamine test	Negative
Nitrate	Positive
Methyl red	Positive
Phenylalanine deaminase	Negative
Motility	Positive
Urease	Negative
Lysine	Positive

Microbiological Tests

These are divided into two parts:

(a) Gram staining done on colonies formed

The Gram staining done on left (test) hand that was inoculated with *Escherichia coli* showed Gram negative bacilli

The Gram staining done on right (control) hand that was inoculated with *Staphylococcus aureus*-showed Gram positive cocci in clusters

(b) Biochemical tests done on left hand colonies that was inoculated with *Escherichia coli*

The biochemical tests done showed that the left hand colonies are positive to catalase, indole, nitrate, methyl red, lysine and motility tests. The colonies were negative to the following tests: oxidase, citrate, phenylamine, phenylalanine deaminase and urease. Table 1 illustrated the biochemical tests

DISCUSSION

Antimicrobial peptides role in innate immunity cannot be over-emphasized. Bacterial organisms had been associated with many diseases. Psoriasis (AMP) had been documented to inhibit *Escherichia coli* in hands (Glaser *et al* 2005). However, the racial and environmental conditions were known to influence diseases. Nigeria is a tropical country located in Sub-Saharan Africa with environmental conditions different from Western Europe or North America. This study showed that the racial, color and geographical location may have influence on the effectiveness of antimicrobial peptide on *Escherichia coli* growth in hands.

The result in Figure I showed that the 16 participants in this study were of equal distribution in sex, colors and racial background. The common factor was that all the participants in this study had lived in Nigeria continuously for at least 5 years thus had experienced the environmental conditions of the tropical country. The variation in skin pigmentation produced by melanocytes resulting in different racial colors was also depicted in this study. It had been documented that psoriasis production is influenced by vitamin D that could also be affected by environmental conditions sunlight exposure (Hegyí *et al* 2012).

The racial differences in microbial isolates are not unexpected. Likewise the genetic linkages to physiologic or pathologic parameters are numerous. Racial and genetic parameters are constant (cannot be changed) but the environmental and dietary factors can be influenced or modified (Peric *et al* 2009). Temperature, the major environmental factor is persistently higher in the tropics than temperate climate. Persistent higher atmospheric temperature (above 37°C) could inhibit the actions of some antimicrobial peptides (Glaser *et al* 2011). Since psoriasis (antimicrobial peptide) is a calcium binding protein, therefore persistent sunlight may impair its activities (Hegyí *et al* 2012).

From the result of this study, it is evident that *Escherichia coli* growth was not inhibited in all the Nigerian resident participants. The Gram staining done on colonies formed from the hand inoculated with *E. coli* showed that it was not inhibited. The un-inhibited growth of *E. coli* inoculated on the hand was confirmed with biochemical tests. The result of biochemical tests done on the hand inoculated with *E. coli* showed that the colonies formed was the inoculated organism (Table I). This finding is in contrary to earlier studies that the hand inoculated with *E. coli* was inhibited (Glaser *et al* 2005).

It has been reported that psoriasis is normally present on the finger tips of all individuals based on the findings from finger-print (Belvin *et al* 2005). However, in this study there was nothing to confirm the normal function of such findings. The possibility of hair follicle as a site of antimicrobial peptide secretion may be a better alternative to psoriasis theory of inhibiting *Escherichia coli* (Wiesner and Vilcinskis

2010). Since the finger tip did not contain the hair follicle, the psoriasis in other parts of the skin may be in normal quantity. Thus the frequent contamination of hand finger tips can lead to infection (Franssen *et al* 2005).

Based on the result of this study, it will not be surprising if permanent resident in tropical countries like Nigeria could be more predisposed to *E. coli* infections in finger tips. Because psoriasis is not only documented to inhibit *E. coli* growth, its impairment will also affect the chemotaxis thus weakening primary innate immune cells (neutrophils) movement to the skin (Wolf *et al* 2008 and Zheng *et al* 2008). Thus antimicrobial agent focusing on presence of skin psoriasis may not achieve the desired therapeutic effect in permanent Nigeria residents.

It has been reported that the psoriasis is over-expressed in invasive breast cancers (Al-haddad *et al* 1999). This is a good indicator for females who are predisposed to invasive breast cancers that have low psoriasis secretion by keratinocytes which may also affect the epithelial cells secretion (Eckert and Lee 2006). Kim *et al* (2009) reported that psoriasis level is high in patients with choleostoma. Nigerians or other black people with apparent low psoriasis level will not be highly predisposed to choleostoma in the middle ear.

Contrary to the earlier reported findings, it is clear from this study that not everybody has antimicrobial peptide (psoriasis) that can inhibit the growth of *Escherichia coli* on finger tips (Belvins *et al* 2005; Glaser *et al* 2011). The link between psoriasis and inflammatory diseases like psoriasis, allergic dermatitis etc was due to the chemotactic activity of this antimicrobial peptide (Anderson *et al* 2009 and Glaser *et al* 2009). It is expected that prevalence of psoriasis and related allergic diseases in permanent residents in Nigeria should be lower than temperate climate region.

This study concluded that antimicrobial activity of psoriasis is not present in all individuals especially the permanent residents in Okada, Edo State of Nigeria therefore there is need for further study on skin antimicrobial peptides (AMP) in the tropics with large population.

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