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The Knicker Study: a survey to determine the incidence of underwear rashes in hot and humid environments.

Introduction and Background

Underwear is something that nearly everyone uses and the sale, to Australian women alone, of various types of undergarments – from the high fashion to the strictly utilitarian, is a \$1.5 billion dollar industry (Byrnes, 2005). What is not so readily assessed or described, however, is the incidence of adverse conditions – skin rashes/heat rashes associated with the wearing of underwear for certain people and in certain conditions, specifically heat and humidity. Much of the research that has been conducted around the incidence of skin conditions has been either clinically based or from the military and sports medicine. Upjohn and Kelly (Upjohn and Kelly, 2004: 64-8), for example, assert that ‘history has shown that skin diseases are an important and often underestimated cause of morbidity in wartime’ and cite a Norwegian military study that found skin disorders made up 16.3% of all consultations. Such disorders are exacerbated in conditions of heat and high humidity and their incidence ‘are similar to those seen in Australian general practice’ (Upjohn and Kelly, 2004: 64-8); (Morgan, 1992: 113-5). A GP data program estimates some 3 million visits to general practitioners are concerned with skin conditions but it is difficult to know which are related to underwear rashes as opposed to skin cancer and other skin conditions (Australian Institute of Health, 2007). An Australian study conducted in rural Victoria in 1998 found 27 percent had reported one or more skin conditions in the preceding two weeks (Kilkenny et al., 1998: 233-7).

One of the difficulties associated with a study of underwear is obtaining a consistency of description for the conditions caused or exacerbated by that underwear. 'Jock Rash' or 'Jock Itch' is medically known as Tinea Cururis and 'Heat Rash' as Miliaria. Whatever the medical condition, there appear to be essentially two types of skin rashes - 'wet rashes' such as the tineas and 'dry rashes' such as eczema and psoriasis. The 'wet' rashes thrive in conditions of moist humidity such as found in the groin and buttocks area and under the breasts in women. This study will describe them as 'heat rashes', 'skin rashes' or 'skin conditions' caused or exacerbated when underwear becomes wet with perspiration and causes chafing or other discomforts. This research project also seeks to lay the groundwork for a more extensive study that would determine whether these conditions can be alleviated by the use of wool underwear.

From anecdotal evidence it would appear that heat rashes are common and are exacerbated in hot and humid conditions. It is also important to stress that humid conditions can occur in cold weather as well as hot as, for example, in the case of military uniforms, 'the battle dress uniform is a tightly woven fabric that decreases airflow' and thus increases the level of humidity experienced by the body (Lowe & Ryan-Wenger, 2003:569). The same comments could also apply to the commonly worn work wear made from densely woven drill fabrics. Whilst speaking of women's experience of vaginal irritations, Lowe & Ryan-Wegner's assessment of the problem associated with these intimate skin irritations might as easily apply to men '(they are) miserable, distracting and significantly affect....quality of life (2003:1). From the perspective of work place health and safety, the distraction and loss of concentration would count as significant public health issues. For military personnel, as Upjohn and Kelly point out, the situation is even more serious as 'these common and usually benign (skin disorders) can become incapacitating if aggravated during deployment' (2004:65).

Although there is considerable literature concerning skin problems in general there is little specific data to accurately gauge the incidence of the problem so far as underwear is concerned. This study aims to address that situation by producing some solid data about the extent of the problem and its associated costs. The research findings may not

be sufficient to indicate the incidence of skin rashes and/or heat rashes in the general population but will be able to be generalized to similar target populations where heat and humidity are important factors.

METHODOLOGY

The research project was conducted over six months, from February, 2008 to July, 2008 and covered 38 sites. Most of the sites were in Queensland but some data was collected from work sites in Western Australia, the Northern Territory and the Solomon Islands. The study was funded through the Next Generation Wool Program of the SheepCRC, a co-operative research centre situated at the University of New England.

The purpose of the study was to determine the incidence of heat-induced heat rashes in hot and humid environments.

RESEARCH DESIGN

How does one limit the parameters of a study?' The design of this study will largely fall within a realist paradigm and follow a quantitative approach. This approach has been chosen as so little specific data exists about the extent of the research problem. The need, then, was for an exploratory study to gather basic data rather than comparative one. These needs, too, have determined the method of data collection. In the first instance a survey questionnaire was used to gather data. The parameters of the study were drawn around identified target populations where high humidity levels were postulated to exist as it is the health implications of underwear that are the important focus of the study and where adverse impacts (medical costs, labour loss, lack of concentration and so on) can be more readily identified and quantified.

The survey instrument was designed with a future hypothesis in mind, namely, that wool underwear will help alleviate the impact of heat rashes. Thus, the same questionnaire could be used with the 'trial wearing of the wool underwear' and any alleviation of

symptoms will be reflected in reduced medical costs, increase in concentration and general well being.

Again bearing in mind the future wearing trials, one of the challenges of the research design may be to test 'like with like'. There are essentially three different styles underwear – briefs (for men commonly known as 'jocks'), boxer shorts and those featuring a longer leg (commonly know as 'little boy leg' or 'trunks'). The majority of underwear commonly available in the Australian market is composed of cotton, cotton blended with various synthetics, synthetics or, more rarely silk. The survey questionnaire was designed to provide data on the most common types of garments worn.

THE SURVEY INSTRUMENT

The survey instrument had several components. The first section was concerned with demographic details – age, gender, occupation and post code for both work and home (to cover the 'fly in/fly out' situation common in mining and exploration industries). The second section asked respondents if they suffered from 'heat rash, skin rashes or chafing?' with a 5 point response Very Often, Often, Sometimes, Not Often and Not at all. Respondents were asked to mark on two blank figure outlines (back and front) where they suffered from rashes. The parts of the body were coded into sixteen different areas. The third section asked the type of underwear worn, their size and the fabric composition of underwear, tops and skirts/trousers. The fourth section covered the cost of medications used, where they were bought (supermarket, pharmacy and/or prescription), had they consulted a general practitioner or specialist about their skin condition and the duration of their rashes.

The fifth section was a Dermatology Life Quality Index (DLQI) developed by, and used with the permission of, Professor Andrew Finlay (Finlay & Khan, 1994:210-6). The quality of life section included nineteen questions that asked how much their skin condition affected their ordinary lives – working, sports, personal relationships and

clothing worn. A last question, Q 20 was added ‘Does discomfort from your heat/skin rash affect your levels of concentration?’

THE STUDY LOCATIONS

The geographic regions covered by the survey were South East Queensland, the Sunshine Coast; Central and Western Queensland and Cairns in North Queensland. Smaller survey sites were a mining operation at Mt Newman in Western Australia, an oil rig off the coast of Darwin and a small sample from the Solomon Islands.

The survey sites were purposefully selected to cover occupations where people were often working outside and where their clothing had to be both protective and durable – commonly densely woven drill fabrics. The hypothesis was that such fabrics would increase the humidity against the body. The occupations covered included agriculture and horticulture, construction, mining, manufacturing, hospitality, sports and a large student selection from James Cook University in Cairns. 464 surveys were completed with 222 being women and 242 men.

The survey period covered late summer to early autumn – from February to May with most surveys being conducted in March and April, 2008. A sample of the March temperatures is set out below:

Location	Mean Lowest Temperature	Highest	Relative Humidity
Brisbane	18.1	27.3	53%
Cairns	23.7	31.2	78%
Quilpie	18.4	33	22%
Darwin	24.4	32.2	66%

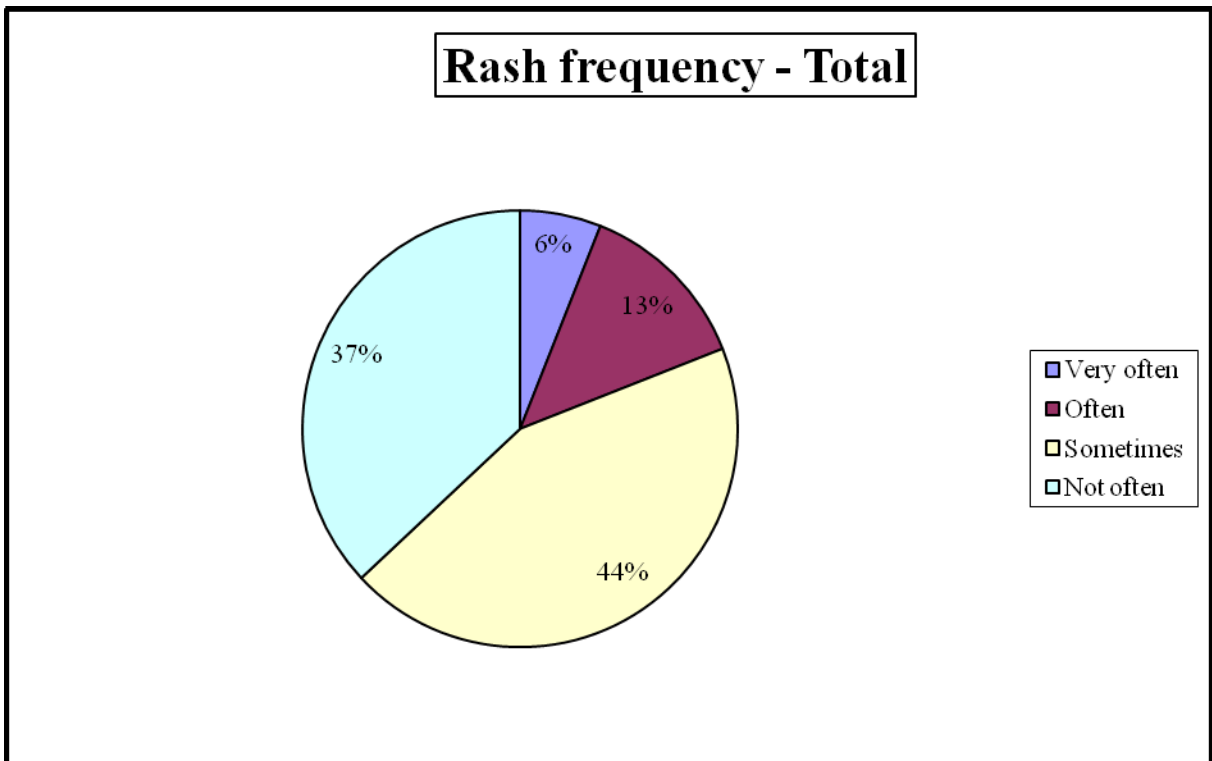
DATA COLLECTION

The data collection method was mostly by personal contact and delivery rather than by telephone or by post with the exception of the far flung mining sites and the Solomon Islands. The method of approach was to identify key industries or organizations, telephone the company, explain the research and seek their co-operation in having their staff complete the questionnaire.

RESULTS

Of the 464 people surveyed, 323 or 69.61 percent reported skin rashes of varying degrees of severity. Men and women were roughly similar in the incidence of rashes reported – 140 women and 183 men. Table 1 below illustrates the breakdown of severity in the rashes reported. The 'Very often' and 'Often' percentages added together would be in line with statistics quoted at the beginning of this report which estimated an incidence in the general population of approximately 16 per cent (Upjohn and Kelly, 2004). The data from this study, however, reveals that the incidence of skin rashes may be greatly under-estimated as witnessed by the large percentage who also suffer rashes but less frequently. There was also a significant variation between sites where, for example, 34 percent of a group of young male automotive students in Brisbane reported having rashes 'Very Often' and 'Often'.

Table 1 Rash Frequency for Total Respondents with Rashes



Spread of Rashes

What is of particular interest in the study results is the spread of rashes which can be seen painted on the body outlines in Table 2 and tabulated in Table 3. It was expected that there would be significant rashes in the underwear regions and this was borne out by the data – 48 percent in the groin/crotch area and 30 percent in the buttocks. Under the breast rashes were reported by 19 percent. What was not anticipated was the spread of upper torso rashes – underarms 24 percent, neck 10 percent, chest and nipples 8 percent (chafed nipples appear to an uncomfortable fact of life for many men – apart from marathon runners who reportedly resort to taping them before running). In total the rashes over the upper body accounted for over 50 percent of rashes. The other significant area of discomfort was the upper thigh which accounted for 34 percent of rashes reported.

Table 2. Spread of Rashes Reported

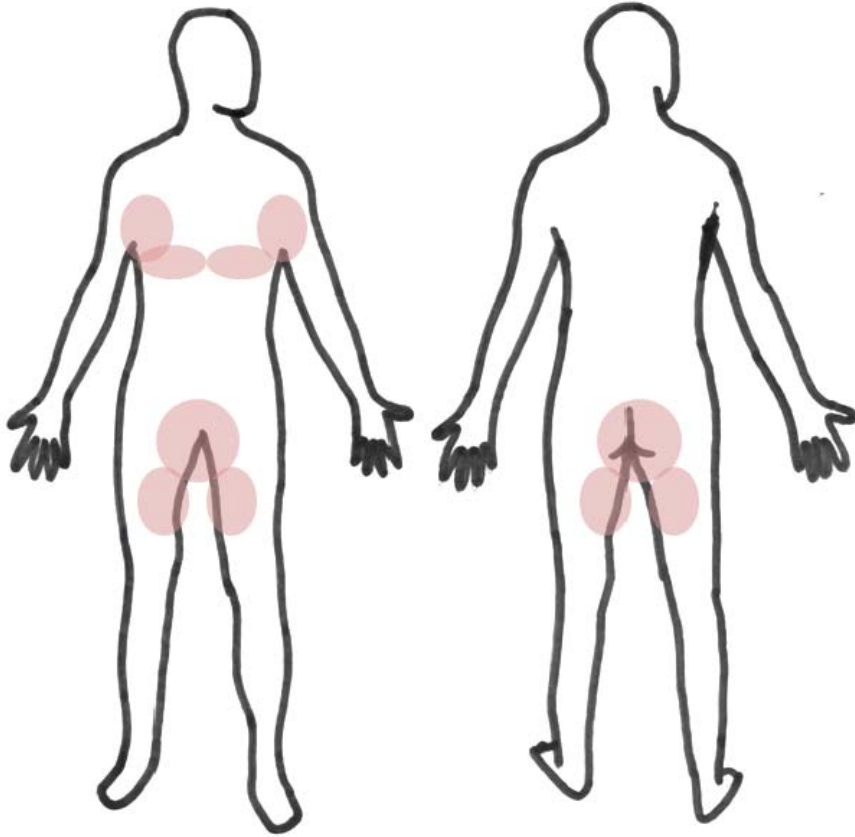


Table 3. Incidence of Rashes Reported

Locality	Incidence	Apparel product
Neck	10%	Shirt, t-shirt top
Back/shoulders	8%	
Underarms	24%	Bras, singlet's, t-
Chest/nipples	8%	

Under breasts	19%	shirts, shirts
Waist	6%	Tops
Groin/crutch	48%	Underpants, shorts and trousers
Buttocks	30%	
Upper thighs	34%	
Knees	8%	Pants and socks
Lower legs	5%	

FABRIC

Of particular note is the fabric worn by those reporting rashes. 41 percent reported wearing 100% cotton underwear, while 29 percent wore 100% cotton shirts or tops and 23 percent wore 100% cotton trousers or skirts. Within the total sample 6 people reported wearing wool underwear, 1 person hemp and 1 bamboo.

STYLE AND SIZE OF UNDERWEAR

Briefs or jocks were the most popular style of underwear worn by those reporting rashes (66 percent) followed by boxers (10 percent) and longer leg (7 percent). 4 percent claimed to wear no underwear and 9 percent a combination of briefs and other styles. A common misunderstanding is that it is larger people who suffer most from underwear rashes. This was contradicted by the data which found that 62 percent of male respondents were size Large or smaller and 69 percent of women were size 14 or smaller.

COST

There are substantial costs associated with skin conditions. In this study 54 percent reported using creams and powders with 26 percent buying them over the counter at pharmacies and 15 percent using products available in supermarkets. Prescription medications were used by 7 percent of respondents. On average, people spent at least \$55.00 per annum on medications but 7 percent spent over \$200.00.

As mentioned above, the results of this survey would suggest that the problems with heat /skin rashes is vastly under-reported but still represents significant utilization of medical resources. 9 percent of respondents had consulted their GP and 3 percent had consulted a dermatologist as well. Nearly half of the respondents with rashes (46 percent) had not consulted their medical practitioners.

QUALITY OF LIFE AND DURATION OF SKIN CONDITIONS

The value of including a Dermatological Life Quality Index (DLQI) in the survey instrument is that it enables a clearer picture of the interaction between several important variables, not the least of which is how skin conditions impact on the ordinary activities of daily life – working, playing sport, choosing clothes to wear, personal and sexual relationships and, most significantly, perhaps, how those conditions affect our concentration. 57 percent reported their skin as itchy and painful over the past month, 54 percent said it affected or interfered with the clothes they were able to wear, 25 percent said it affected them at work and nearly a third of affected respondents (29 percent) reported their skin condition as affecting their concentration. The results also reveal a significant amount of discomfort and suffering. Less than 20 percent of respondents (19 percent) reported their skin conditions as having a duration of less than 1 year. Nearly half (47 percent) said their rash problems had affected them for more than 5 years with 28 percent saying longer than 10 years.

NATURE AND FORM OF RESULTS

As there is so little data available about the specific nature of skin rashes caused or exacerbated by underwear, this small exploratory study will be valuable in establishing

some demographic information, the extent of the problem within certain target populations and the diverse costs associated with such conditions.

The results from this survey cannot be generalized to the general community but will be representative of the target population – people working in and outdoors in conditions of heat and humidity and will provide an important basis for future research.

One of the questions omitted from the survey questionnaire concerned the yarn composition of socks. Had this been known it might have explained the relatively low level of rashes associated with the feet and ankles (4 and 2 percent respectively). One could hypothesize that, while wool has largely disappeared from clothing from the knees up, wool socks are both readily available and widely worn and might play their part in reducing the incidence of heat related rashes and tinea.

DISCUSSION

The results of the survey conducted have revealed many problems experienced by people living in tropical and sub-tropical climates – a significant incidence of underwear rashes and a substantial number of upper torso and upper thigh rashes. Skin conditions have been identified in the diverse literature as a major public health issue and one that has significant personal and public costs in terms of suffering, lack of well being and direct medical and pharmaceutical costs. When skin conditions cause a lack of concentration at work they also constitute an occupational health and safety issue. A thread throughout the dermatological literature laments the fact that dermatology is not given sufficient weight during the training of health professionals, especially doctors and it is remarkable that some 46 percent of this survey sample had not sought help from their general practitioner. Another study of psoriasis patients in the UK, however, found some 80 percent had not consulted their doctors about their condition (O'Neill and Kelly, 1996:919-21). Whatever the cause, embarrassment and/or ignorance on the part of both the medical fraternity and affected individuals, there is a consensus in the literature that common skin conditions cause a significant loss of well being and

disability in the community (Harlow et al., 2000:979-82, Cole & Gray-Miceli, 2002:377-84).

There is no evidence in the literature that underwear can be, or is being designed to minimize underwear rashes. With bras, it is frequently asserted, without supporting research evidence, that many of the under the breast rashes are due to ill-fitting garments. This may well be true but the fact remains that most women buy their bras in 'self service' department stores where proper advice on fitting – and suitable fabric is not available.

Some of the implication for fashion, product development and future research are set out below. Almost all would come under the heading of 'Health and Healing Benefits of Wool' or 'Wool and Well Being'.

FUTURE DIRECTIONS FOR RESEARCH

1. Underwear

Substantial anecdotal evidence over a number of years suggests that underwear rashes can be 'cured' (or at least substantially alleviated) by the simple process of changing your knickers to wool ones. The results of this survey challenge the advice in some of the medical literature to 'wear cotton' to prevent and/or alleviate heat and skin rashes. There is a need for the benefits of wool underwear to prevent and/or alleviate heat rashes to be tested under clinical supervision.

2. Health Care wear: 'Health Fashion' and Ageing Populations

There has been little research conducted on skin/fabric interactions to prevent pressure sores and heat rashes for immobilized patients or the disabled more generally. The anti-odour properties of wool could be harnessed to design attractive and functional garments for patients who suffer odour due to excessive perspiration caused by fevers, infections and lying on impermeable mattress covers.

The ageing population, whilst widely mentioned as an emerging 'problem' is seldom seen as a developing market for fashion or wool fashion that warrants serious attention

and research. As Thomas, however, points out, ‘the gray boomers....are rediscovering their idealism, the “ethics” of their youth...they are becoming more socially and environmentally aware’. (Thomas, 2003: 49-52).

An example of an innovative use of both design and fabric technology to meet the needs of women after breast cancer surgery is the recently launched range of ‘recovery garments’. A wool/lycra blend fabric (designed and tested by CSIRO) promotes healing – and obviates the need to wear ugly and uncomfortable compression bandages (Powell, 2008).

3. Tropical and sub-tropical clothing for work, sports and leisure

Many of the developing markets for fashion and wool products are in tropical and sub-tropical areas. From the limited wearer trials, anecdotal evidence and the literature, it is clear that much of the clothing currently available is not adequately designed in suitable fabrics for use in hot and humid conditions. As one of the trial wearers reported from the Solomon Islands with her request for some wool shorts to play golf;

‘My cotton ones get saturated and weigh me down’.

4. Work wear and Military Uniforms

The incidence of upper torso rashes and upper thigh rashes suggest that current work wear could be better designed and made in a fabric (a wool/cotton blend, for example) that would be more suitable for hot and humid environments and general tropical and sub-tropical use.

A number of industries (mining, hospitality, agriculture, construction, for example) involve having their staff work in extreme conditions. The temperature in kitchens, for example, can rise to 55 degrees as can roof areas which is a common worksite for refrigeration mechanics. It could be suggested that the comfort and safety of these workers would be the prime consideration in the choice of uniforms – rather than the added cost of say, a wool/cotton blend fabric.

5. Climate Change and Environmental Concerns

There has been much debate about the possible health implications of climate change – increased risk of skin cancer, heat stress, and insect borne diseases to name just a few. There is little attention in the literature, however, given to the fact that clothing could play an important role in mitigating some of these effects – and could open up new and developing markets for suitable fabrics where wool and wool blends might find a place. Environmental concerns are not going to go away and, instead, may be the defining movement of this century. Thomas, quotes Edwin Datschefski as saying in 2001: ‘Sustainability is inevitable – it’s now about who will be first to gain a beachhead. Already firms are claiming major strategic stakes in what will be a trillion-dollar business in the next five years’(Thomas, 2003: 49-52).

Sandy Black, writing in *Echo-Chic. The Fashion Paradox* asserts that ‘consumers are demanding to know more about how and where and in what conditions their clothes are made’(Black, 2008). Against this, however, is ‘the cheap teen fad’ for disposable clothing which has been identified as a major problem for the sustainability of fashion in its total supply chain (Tilley, 2008b:39, Tilley, 2008a:11). These major trends require sustained education campaigns on the part of the industry to enable the links between the ‘desire to be green’, sustainability and fashion to be fully explored.

CONCLUSION

Australia is a world leader in wool science and technology and it is the largest producer of top quality wool fibre. It could be suggested, then, that Australia has all the necessary elements to solve many of the problems identified in the survey results and subsequent discussion above – skin problems, more suitable clothing for tropical and sub-tropical climates, especially underwear, and better work wear and military uniforms specifically designed for hot and humid environments.

Prevention of illness and injury has rarely, perhaps, been aligned with ‘fashion’. The challenges identified in this research, however, point the way for some more detailed

research on the role that clothing, and specifically underwear, has in maintaining health and well being. The study has identified new and emerging markets; it has identified the possible health benefits of wool underwear and it might now inform the development of new products that are well designed, attractive and appealing - and good for your health and hip pocket.

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