

### Moisture Management Properties and Characterization of Fabrics for Lusomé: Review of "Cooling" Sleepwear Products on the Market

### Supplementary Report

Prepared for Lusomé

July 2022

Ms. Jennifer Beaudette & Dr. Rachel McQueen Department of Human Ecology, University of Alberta

### Table of Contents

| 1.0              | Purpose  | . 2 |  |  |  |  |
|------------------|--|-----|--|--|--|--|
| 2.0              | Overview of fibres used in "cooling" sleepwear                                     | . 2 |  |  |  |  |
| Tab              | Table 1. Apparel and sleepwear brands that promote wicking, cooling, temperature   |     |  |  |  |  |
| regi             | ulating sleepwear  |     |  |  |  |  |
| 3.0              | Reported textile properties of "cooling" sleepwear fabrics                         | .4  |  |  |  |  |
| Tab              | le 2. Common properties reported by brands in the marketing of sleepwear items for |     |  |  |  |  |
|                  | sleepers   |     |  |  |  |  |
| 3.1              | Breathable   |     |  |  |  |  |
| 3.2              | 5  |     |  |  |  |  |
| 3.3              | Cooling properties and cool-to-the-touch   |     |  |  |  |  |
| 3.4              | Temperature-regulating   | .7  |  |  |  |  |
| 3.5              |  |     |  |  |  |  |
| 3.6              |  |     |  |  |  |  |
| 3.7              | Antibacterial and low odour  | . 8 |  |  |  |  |
| 3.8              |  | . 9 |  |  |  |  |
| 4.0              | Sleepwear/bedding brands that focus on sleepwear for hot sleepers and those who    |     |  |  |  |  |
| experi           | ience night sweats   | . 9 |  |  |  |  |
| 4.1              | Cool Girl  | .9  |  |  |  |  |
| 4.2              | Cool-jams  | 10  |  |  |  |  |
| 4.3              | CoolRevolution   | 11  |  |  |  |  |
| 4.4              | Dagsmejan  | 12  |  |  |  |  |
| 4.5              | SHEEX  |     |  |  |  |  |
| 5.0              | Sleepwear/bedding brands with only some products advertised for hot sleepers and f | or  |  |  |  |  |
| people           | e who experience night sweats  | 14  |  |  |  |  |
| 5.1              | Cloud Nine Pajamas   | 14  |  |  |  |  |
| 5.3              | Eberjey  | 16  |  |  |  |  |
| 5.4              | Ekouaer  | 16  |  |  |  |  |
| 5.5              | Ettitude   | 16  |  |  |  |  |
| 5.6              | GYS Brand  | 17  |  |  |  |  |
| 5.7              | Joyaria  | 17  |  |  |  |  |
| 5.8              | Karen Neuburger  | 18  |  |  |  |  |
| 5.9              | Latuza   | 18  |  |  |  |  |
| 5.10             | ) Sleepytime pajamas   | 19  |  |  |  |  |
| 5.1 <sup>°</sup> | 1 Softies  | 19  |  |  |  |  |
| 5.12             | 2 This is J  | 21  |  |  |  |  |
| 5.13             | 3 Wiwi   | 21  |  |  |  |  |
| 5.14             | 4 Yala   | 22  |  |  |  |  |
| 6.0              | Brands that produce many types of apparel item, but have some sleepwear items or   |     |  |  |  |  |
| lines f          | or hot sleepers  | 22  |  |  |  |  |
| 6.1              | Athleta  | 22  |  |  |  |  |
| 6.2              | Chill Angel  | 22  |  |  |  |  |
| 6.3              | Fishers Finery   | 23  |  |  |  |  |
| 6.4              | Hotouch Brand  |     |  |  |  |  |
| 6.5              | Lilysilk   |     |  |  |  |  |
| 6.6              | Lunya  |     |  |  |  |  |
| 6.7              | Soma   | 25  |  |  |  |  |
| Refere           | ences  |     |  |  |  |  |

#### 1.0 Purpose

There are many brands that market sleepwear and make similar claims about their moisture management or cooling effects as Lusomé's Xirotex<sup>™</sup> fabrics. The purpose of this supplementary report was to identify brands that promote sleepwear for "hot sleepers" those who experience "night sweats" or "hot flashes" and discuss their claims that relate to cooling or wicking benefits. These brands were identified firstly through an internet search and then through a search for media articles that reviewed sleepwear with "cooling" effects for "hot sleepers". Unlike the main report, the fabrics of the brands making these claims were not tested for liquid moisture management properties. However, the brands of the five fabrics that were tested in the main report are included in this supplementary report. The first part of this report summarises the fibre types that are used for cooling sleepwear, followed by a discussion of the types of properties that are reported as being beneficial in their sleepwear items by the various brands. Lastly, a summary of key statements/claims about their cooling, wicking or other benefits that were found on the website of the brand or online retailers selling the "cooling" sleepwear item are made.

#### 2.0 Overview of fibres used in "cooling" sleepwear

There are a number of brands that market their sleepwear as beneficial for people who experience night sweats, hot flashes or more generally for people who are just "hot sleepers". For some brands, their sleepwear items appear to be mainly focused on this market segment (e.g., CoolRevolution<sup>TM</sup>, Dagsmejan), whereas for other brands only some items among larger sleepwear ranges purport these benefits (e.g., This is J, Cozy Earth). Some brands include sleepwear as only part of their categories as they also produce and sell many other items of consumer apparel items (e.g., Fishers Finery, Soma).

A list of brands that market sleepwear for "hot sleepers" or those who experience night sweats is shown in Table 1. The fibre content of the "cooling" or "wicking" sleepwear is also provided in the table.

The majority of cooling sleepwear is composed of viscose made from bamboo. Viscose is never used entirely on its own, all brands that produce sleepwear of viscose include at least 4% of spandex in order to improve the fit and elastic recovery of their products. In their propriety fabric technology Nattcool<sup>™</sup>, Dagsmejan uses lyocell which, like viscose, is a type of rayon fibre. However, the lyocell process is different from the viscose process and the fibres can exhibit slightly different properties (e.g., lyocell has higher strength than viscose) [1]. Modal is another type of rayon fibre that differs from the viscose process. Modal is used in Eberjey's Gisele sleepwear line. Some brands have not specified the type of rayon they used (e.g., Cool Girl). For others, the source of cellulose used to produce the rayon fibres may be provided, for example, CoolRevolution<sup>™</sup> use rayon from bamboo in their sleepwear. The Cool Calm line of sleepwear from Athleta is composed of cupro rayon. Regardless of the type of rayon, or the source from which the rayon is produced, all rayon fabrics are highly absorbent and have a low modulus [2]. The fibre modulus refers to how easily fibres can bend and stretch when a small force is applied [1]. This means that all rayon fibres are flexible and soft to the touch. Humphries [2] describes viscose and cupro rayon fabric properties to have a "cool hand".

| Brand               | Fibre content of sleepwear                                      | ltem in main<br>report? |
|---------------------|---|-------------------------|
| Sleepwear/bedding b | rand with focus on sleepwear/bedding for hot sleepers           |                         |
| Cool Girl           | 58% rayon, 37% polyester and 5% spandex                         | No                      |
| Contractor          | 64% rayon, 30% polyester and 6% spandex                         | Mar                     |
| <u>Cool-jams</u>    | 100% polyester (although not explicitly stated on               | Yes                     |
|                     | their website - at times referred to as 100%                    |                         |
|                     | polymicrofiber on Amazon)                                       |                         |
| CoolRevolution      | 66% bamboo rayon/ 28% cotton/ 6% spandex                        | No                      |
| <u>Dagsmejan</u>    | Nattcool <sup>™</sup> fabric: 92% lyocell/ 8% spandex (stated   | No                      |
|                     | 92% microlyocell from eucalyptus/ 8% Lycra®                     |                         |
|                     | elastane)   |                         |
| <u>SHEEX</u>        | SHEEX® Performance fabric: 87% polyester / 13%                  | No                      |
|                     | spandex   |                         |
|                     | rand, but only some products advertised for hot sleepe          | rs and night sweat      |
| Cloud Nine Pajamas  | Scarlett Ellie: 96% bamboo viscose/ 4% spandex                  | No                      |
|                     | Georgia Rylan: 95% bamboo/ 5% spandex -                         |                         |
|                     | presumably viscose from bamboo.                                 |                         |
| Cozy Earth          | 95% bamboo viscose / 5% spandex                                 | No                      |
| Eberjey             | 95% Tencel <sup>™</sup> modal/ 5% spandex                       | No                      |
| Ekouaer             | Polyester and spandex (proportions not stated)                  | No                      |
|                     | Rayon and spandex (proportions not stated)                      |                         |
| Ettitude            | 100% bamboo rayon   | No                      |
| GYS                 | 95% bamboo viscose/ 5% spandex                                  | No                      |
| Joyaria             | 95% bamboo viscose/ 5% spandex                                  | Yes                     |
| Karen Neuburger     | 60% cotton/ 40% polyester                                       | Yes                     |
| Latuza              | 95% bamboo viscose/ 5% spandex                                  | No                      |
| Sleepytime          | Sells through Amazon and other online retailers.                | No                      |
| seepyenne           | Exact fibre content is unclear, presumably major                | 110                     |
|                     | proportion viscose from bamboo and some                         |                         |
|                     | spandex.  |                         |
| Softies             | Wellness Fabric®: 81% polyester/ 14% lyocell/ 5%                | No                      |
| <u>JUITIES</u>      | spandex   | NU                      |
| This is 1           |   | No                      |
| This is J           | 93% bamboo viscose / 7% spandex                                 | No                      |
| <u>Wiwi</u>         | 95% bamboo viscose / 5% spandex                                 | No                      |
| <u>Yala</u>         | 95% bamboo viscose / 5% spandex                                 | No                      |
|                     | of apparel, some items are sleepwear for hot sleepers/          |                         |
| <u>Athleta</u>      | Nighttime Bliss: Tencel™ modal/ spandex                         | No                      |
|                     | (fibre proportions not provided on website)                     |                         |
|                     | Cool Calm: Cupro rayon (presumably 100%)                        |                         |
| Chill Angel         | 100% merino wool  | No                      |
| Fishers Finery      | EcoFabric <sup>™</sup> : 70% bamboo viscose/ 25% organic        | No                      |
|                     | cotton/ 5% spandex  |                         |
|                     | EcoFlannel™: 70% bamboo viscose∕ 30% organic                    |                         |
|                     | cotton  |                         |
| Hotouch             | Not clear.  | No                      |
| Lilysilk            | 100% silk   | No                      |
| Lunya               | 100% silk ("washable mulberry silk")                            | Yes*                    |
|                     | 69% Pima cotton, 23% viscose, 8% polyester                      |                         |
|                     | 100% cotton   |                         |
| Soma                | Cool Nights® fabric: 93% rayon/ 7% spandex                      | Yes                     |
|                     | bric composition tested in main report could not be found on th |                         |

| Table 1. Apparel and sleepwear brands that promote wick | king, cooling, temperature |
|---|----------------------------|
| regulating sleepwear                                    |                            |

\*an item with the same fabric composition tested in main report could not be found on their website

Other fibre types that are used by various brands are polyester, silk, and, in one case, merino wool. Cool-jams, SHEEX® and the Wellness Fabric® by Softies use a high proportion of polyester in their cooling sleepwear fabrics. In fact, Cool-jams sleepwear are 100% polyester. Cool Girl and Karen Neuburger use a lower proportion of polyester (~40%), with the majority of the fibre content rayon or cotton. Lilysilk and Lunya have 100% silk sleepwear, and Chill Angel has products they advertise for sleeping in 100% merino wool.

#### 3.0 Reported textile properties of "cooling" sleepwear fabrics

There are many common themes among the types of properties the various brands state their sleepwear items have. Table 2 presents a list of properties that are reported as the properties or benefits that these sleepwear items will have. For some brands, these properties appear to be across the board for all of their pajamas and nightgowns (e.g., Cool-jams, SHEEX®), whereas, for others, such properties are limited to specific items or a line of sleepwear products (e.g., Athleta Cool Calm).

| Performance                                      | Brands reporting these properties   |  |  |
|--|---|--|--|
| property   | Across their product lines  | Specific to select sleepwear items   |  |
| Breathable                                       | Cool-jams, CoolRevolution,<br>Dagsmejan, SHEEX, Cloud Nine,<br>Cozy Earth             | Ekouaer, Ettitude, GYS, Latuza, Lunya,<br>Sleepytime, Softies, Wiwi, Yala, Athleta's<br>Cool Calm, Chill Angel, Fishers Finery,<br>LilySilk, Lunya |  |
| Wicking  | Cool Girl, Cool-jams,<br>CoolRevolution, Dagsmejan,<br>SHEEX, Cloud Nine, Cozy Earth, | GYS, Joyaria, Karen Neuburger®, Latuza,<br>Sleepytime, Softies, This is J, Wiwi, Fishers<br>Finery, LilySilk                                       |  |
| Absorbent  | Cool-jams, Dagsmejan, Cloud<br>Nine   | Latuza, Softies  |  |
| Cooling properties                               | Cool Girl, Cool-jams,<br>CoolRevolution, Cozy Earth,<br>Dagsmejan                     | Ettitude, GYS, Karen Neuburger®,<br>Sleepytime, Softies, Lunya, Fishers Finery,<br>LilySilk, Soma,   |  |
| Cool to the touch                                | SHEEX   | GYS, Athleta's Cool Calm, Soma   |  |
| Temperature-<br>regulating                       | CoolRevolution, Dagsmejan,<br>Cloud Nine, Cozy Earth                                  | Eberjey, Latuza, Softies, This is J, Yala,<br>Chill Angel, Lilysilk, Lunya   |  |
| Quick drying                                     | Cool Girl, Cool-jams,<br>Dagsmejan, CoolRevolution,                                   | Softies  |  |
| Soft   | Cool Girl, Cool-jams,<br>CoolRevolution, Dagsmejan,<br>SHEEX, Cloud Nine              | Ettitude, GYS, Joyaria, Latuza Sleepytime,<br>Softies, This is J, Wiwi, Yala, Athleta's Cool<br>Calm, Hotouch                                      |  |
| Antibacterial                                    | Cool-jams, CoolRevolution   | Latuza, Softies, This is J   |  |
| Low odour  | Cool Girl, Cool-jams, SHEEX,<br>Cloud Nine  | Latuza (implied), Softies, This is J,  |  |
| Good for sensitive<br>skin or "skin<br>friendly" |   | Latuza, Wiwi, Lilysilk   |  |

### Table 2. Common properties reported by brands in the marketing of sleepwear items for hot sleepers

The two most common themes among the sleepwear brands/ products identified as being good for "hot sleepers" were moisture wicking and breathable. However, a number of brands also specifically mentioned cooling properties, temperature regulation or quick-drying, which were the next most common themes related to the cooling benefits of sleepwear textile properties. Other terms that do not directly relate to cooling benefits, but are important in terms of the overall comfort of sleepwear are those related to the softness of the fabric, or low odour properties.

#### 3.1 Breathable

The term "breathable" was commonly used to describe the properties of the sleepwear fabrics and used by the majority of brands. Breathability generally refers to the moisture vapour permeation of a waterproof fabric, but has been adopted by many apparel brands to try to describe the general moisture-related comfort of their clothing. As a fabric that allows air to pass through the structure, then any fabric with some air permeability will allow moisture vapour to also pass through. The ways in which the concept of "breathability" is interpreted appears to be a little different among some of the brands.

Some of the statements link the concept of breathability directly with the movement of air through the fabric (e.g., Cool-jams, Athleta). For example, in their Bliss products Athleta state they are "breathable" because "airflow moves easily through the garment". Whereas, when describing breathability Lilysilk connects breathability with thermal regulation. They state that "silk is a very breathable fabric making heat escape through it".

Other brands may make statements linking breathability of the fabric to the skin "breathing" (e.g., Ekouaer). A generous interpretation of the concept of the skin "breathing" could relate to the release of moisture vapour from the skin, but skin itself does not breathe.

Sometimes a link between natural or hydrophilic fibres and the concept of breathability are made, where natural/regenerated cellulosic fibres by their nature form a "breathable" fabric (e.g., Lilysilk). However, brands that produce sleepwear from mostly synthetic fibres (e.g., Cool-jams, SHEEX) also make claims about the breathability of their sleepwear. As all the brands in this supplementary have sleepwear that is marketed as "cooling" and intended to be slept in, then it is safe to assume that air and moisture vapour will pass through all their fabric structure relatively easily. Therefore, regardless of fibre type, these fabrics should all be "breathable".

#### 3.2 Wicking and absorbency

Wicking was the second most common term that was used in the information provided by brands about their "cooling" sleepwear. Wicking refers to the flow of liquid moisture via capillary action, and wicking occurs as liquid moves along the surface of the fibres [1]. Although, the spreading of liquid moisture that can occur in fabrics composed of hydrophilic fibres (i.e., water loving fibres) involves absorption into the fibres as well. Interestingly, the term 'absorption' is used far less often to describe cooling sleepwear.

The concept of moisture wicking has frequently been connected to the cooling nature of the sleepwear. For example, Cool Girl claims that their wicking performance will lead to keeping you "cool and dry". Many of the brands that use rayon (viscose) fibres in their lines tend to connect wicking as a natural characteristic of rayon fibres. As This is J states that bamboo

viscose is inherently moisture-wicking. While Latuza states that "compared to polyester and cotton fabric, bamboo viscose fabric can wick away excess moisture". However, this is not an accurate representation as polyester fibres do not absorb moisture into their structure they are often recognized to be excellent wicking fabrics when they are shaped to enable channels for capillary action [1]. Latuza did also state that bamboo viscose was extremely absorbent which is correct. The absorbency of viscose rayon and its ability to take in liquid moisture may contribute to the belief that bamboo viscose is a wicking fabric, as the fibres are wet and liquid moisture can be absorbed and spread through the fabric structure via capillary action. In one study measuring liquid moisture using the Moisture Management Tester (MMT), the authors found that one-way wicking performance was superior in a 100% polyester fabric than a 100% bamboo viscose fabric [3]. However, each fabric should be tested and evaluated to provide evidence of enhanced wicking performances.

Some brands have mentioned how the wicking performance of their fabric technologies are embedded into the fabrics (e.g., Cool-Jams) or in the drirelease® fabric used in by Softies in their Wellness Fabric® sleepwear. In fact, Softies have stated that in their Wellness Fabric® the wicking performance will not wash out as they have not used chemicals in their fabrics to give them wicking properties. Softies go on to make bold claims about the benefit of their wicking fabrics as it "keeps excess moisture at bay" people will "face the day well rested and refreshed" (Softies Wellness Fabric®).

#### 3.3 Cooling properties and cool-to-the-touch

As the sleepwear brands and specific lines of sleepwear were often marketed to be "cooling" and good for "hot sleepers" then it was not surprising that cooling properties were another commonly used phrase. Some brands explicitly stated that their sleepwear products were "cooling" such as CoolRevolution<sup>™</sup>. A few brands implied that their sleepwear would keep the skin or body cool and comfortable "all night long" (e.g., Cool-jams, Cool Girl).

Cooling properties were often connected with moisture wicking and the evaporative cooling effect that can occur as the moisture that is wicked away evaporates (e.g., Dagsmejan). Dagsmegjan make an unusual connection about fibre content in respect to moisture wicking and evaporative cooling. They appear to claim that not all fabrics that can wick moisture away allow evaporative cooling to occur. It appears that their fabrics can allow evaporative cooling while synthetics may not, as they refer to their materials that are made from natural materials as the "best option for a combination of moisture wicking and evaporative cooling". Many performance fabrics that rely on "cooling technologies" use synthetic fibres, sometimes 100% synthetic (e.g., Coolmax®). Therefore, there is evidence of the benefits of synthetics in cooling materials, as least in the activewear markets, yet the effectiveness of evaporative cooling as moisture evaporates from the fabric surface may have more to do with fabric thickness than fibre content [4].

SHEEX's performance fabrics are made from predominantly polyester and they state that their fabrics can "transfer heat up to 10x more effectively than traditional cotton". This could be due to quicker drying since cotton fabrics can become saturated with liquid moisture. However, statements such as this are often vague and they do not provide sufficient information about the fabrics in which the brands' fabrics were compared against (e.g., fabric thickness, fabric structure). A different but similar type of claim was also made about the cooling effects of Cozy Earth fabrics where they state that their 95% bamboo viscose/5% spandex sleepwear will feel "degrees cooler than cotton".

Some brands made statements related to their fabrics being cool-to-the-touch. This is slightly different from cooling properties, but does influence the thermal properties. The SHEEX sleep-fit provides "cool-to-the touch feeling" and GYS state that one of their 95% bamboo viscose/5% spandex sleepwear items is "cool against the skin". Cool-to-the-touch relates to the sensation of the contact with the skin and fabric. Usually, long continuous filament yarns (or made from longer staple fibres spun into tightly twisted yarns) made into a fabric that is smooth will feel cool-to-the-touch compared with to fabric made from short staple yarns with raised fibre ends on the surface (e.g., smooth sateen sheets vs. napped flannel sheets).

#### 3.4 Temperature-regulating

Temperature regulating is another characteristic that relates to thermal properties of sleepwear fabrics that many brands have made about their entire lines, or selected items. Sometimes the terms "temperature-balance" or "temperature managing" may also be used. What constitutes temperature regulating sleepwear in terms of the types of garments that are sold is somewhat unclear. Presumably, the temperature regulation that can occur relates to the ability of the fabrics to take in moisture and dissipate as required based on the body's own thermoregulatory processes. Some more advanced technologies could utilize phase change materials to 'regulate' the temperature of the body more actively. However, it does not appear that any of the sleepwear brands shown in Table 1 incorporate this type of technology. An internet search revealed a sleepwear line called "Just Right" launched by the US retailer Dillard's which used Outlast Technologies in 2007 [5]. However, it does not appear that this sleepwear line is still commercially available. Another type of temperatureregulating sleepwear (also not presented in Table 1) is the Janus Sleepwear that has a bilateral fabric garment design where there is a conducting fabric on one side of the body (e.g., left side) and insulating fabric on the other (e.g., right side). The sleepwear design allows the sleeper to regulate their own thermal comfort during the night by switching sides as they sleep [6].

Of the brands examined in this supplementary report, CoolRevolution<sup>TM</sup> states that their "naturally temperature-regulating fabric keeps you cool when you get hot and warm when you get cold". Dagsmejan state that their temperature regulation sleepwear is breathable and this is how heat can be released. Whereas, Lilysilk go so far as to state that their silk fabrics act like a "natural thermostat". Their messaging is a little convoluted and contradictory as they state "silk is a very breathable fabric making heat escape through it, and because of its insulating characteristics, you will get a constant stream of fresh air in without having to worry about feeling cold". Avoiding excessive wetness and fabrics that causing 'chilling' after a period of sweating and the body has cooled down may be the best passive method of 'regulating' temperature.

#### 3.5 Quick drying

Reference to fast or quick drying was also frequently made by many of the brands. Interestingly, when such statements were made they were often comparative with sleepwear fabric technologies often being compared to other fabrics - usually cotton. For example, Cooljams have stated that their technologies "dry 4 x faster than cotton" or Dagsmejan's sleepwear fabrics "dries in 1/3 of the time of cotton". Softies Wellness Fabric® is claimed to "dry four times faster than cotton". The ability of the fabric to dry relates to how much moisture the fabric has absorbed. As polyester fibres do not absorb moisture into the internal structure of the fibre then all the moisture is held on the surface of the fibres. Therefore, garments made from polyester will usually dry faster than garments made from cotton and other cellulosic fibres. However, when fibre types are more similar, then certainly the thickness of the fabric becomes the most important factor influencing drying time. Among cellulosic fabrics thinner fabrics will dry more quickly than thicker fabrics irrespective of the type of cellulose (e.g., some viscose dried more slowly than cotton) [7]. Therefore, comparative statements related to drying time should be qualified further by including the fabric thickness into their statement.

#### 3.6 Softness

As tactile comfort of clothing worn to sleep in is an important quality, it is not surprising that softness is a property frequently referred to by the brands. Like drying time, softness was sometimes compared to be like another fibre content that the stated fabric was not. However, in this type of comparison the other fibre was upheld like it was the "gold standard" for softness. For example, Cool-jams state that their polyester fabrics have a "super soft 'cotton-like' comfort and feel". While CoolRevolution<sup>™</sup> have claimed that their bamboo viscose sleepwear "feels soft and silky against your skin". SHEEX have even gone so far as to register the term "ridiculously soft" to describe the softness of their performance fabric. One benefit of viscose fibres in sleepwear, and possibly a testament to their popularity, is their inherent softness. Viscose fibres have a low initial modulus (meaning they can bend easily) and are therefore very flexible.

#### 3.7 Antibacterial and low odour

Antibacterial statements are often made in conjunction with anti-odour or odour control claims. For example, Cool-jams state that their technologies eliminate odour-causing bacteria with their "natural antibacterial treatment". Many of the statements about antibacterial (or antimicrobial) and odour control are not clearly supported by the science. Some brands have alluded to bamboo as being "inherently antibacterial". CoolRevolution<sup>™</sup> state that "Bamboo is naturally cooling, moisture-wicking and antibacterial". As well, This is J states that the reason they like working with bamboo in their sleepwear lines is that it is: "inherently antibacterial, anti-fungal, odour resistant, moisture wicking and durable". Latuza state in a section about bamboo viscose fabrics that they are "naturally antibacterial," they even go further and state that "by wicking away moisture—whether you are awake or whether you are asleep—bacteria can't grow as easily on your skin. In other words, your skin will be healthier. You will stay fresher. And your skin will have less of an odor". These claims are clearly unsupported by the science. Any 'inherent antimicrobial' properties that the bamboo plant may have will not persist through the manufacturing process to the final rayon fibre [8].

Cool-jams is one company that implies they do have an antimicrobial treatment that is applied to the fabrics (rather than inherently antibacterial). Softies' Wellness Fabric® is another sleepwear brand that provides information about an antimicrobial finish as their fabrics are "protected by antimicrobial technology" that will stay "fresh, comfortable and clean between washes". What the natural antibacterial treatment that Cool-jams uses, and how effective their treatment is at eliminating bacteria within the fabric, is not provided, nor is this information provided by Softies. This is important as some antimicrobial treated fabrics do not show antimicrobial properties during use [9]. Furthermore, controlling bacteria in the fabric does not necessarily control odour [10]. Lilysilk also state that studies have "shown that silk possesses certain traits such as its naturally hydrophobic nature and its inherent antimicrobial, antibacterial, and antiviral properties". To our knowledge there is no evidence that processed silk has inherent antimicrobial properties and the website does not include a link to any studies. In fact, there are many studies where antimicrobial agents such as silver ions or silk has been added to impart antimicrobial properties to the textile [11], which suggests silk does not have inherent antimicrobial properties. Claims such as these have been made in relation to wool and bamboo made from viscose which are also not supported by the science [8, 12].

#### 3.8 Skin friendly

Being 'skin friendly' is a statement that was made by very few sleepwear brands. It is not entirely clear what skin friendly means in some instances. It is possible that Wiwi when they refer to their "silky-soft" 95% viscose bamboo/5% spandex that is "skin friendly" may relate to the softness of the fabric, which does not irritate the skin - as opposed to stiff fibres that can be scratchy.

Lilysilk perhaps make the boldest claims to skin friendly, as they refer on their website that silk is "naturally hypoallergenic" and that "sericin is naturally infection resistant, so it can keep away dust mites, mold, bacteria, and other common allergens". They also go on to say that:

"silk is also free of any potential irritating chemicals and toxicants, so it can be worn safely even for people with sensitive skin. It's no risk of causing eczema flare-up, skin rashes or dreaded stuffy nose that allergy sufferers cannot be more familiar with."

Although there is little evidence of skin sensitization to the processed silk fibre among consumers at large once the sericin is removed, there has been reportedly well-known recognition of allergies to the sericin in silk within the industry [13]. Once sericin is removed, the fibroin protein of the silk fibre has "low allergenic potential" [13]. Silk fabrics have been used as a textile for people who suffer eczema, however, many silk products recommended for sufferers of atopic dermatitis have additional antimicrobial treatments added to minimize the buildup of bacterial such as *Staphylococcus aureus* [14]. In a clinical trial examining silk garments as an additional treatment for children suffering atopic dermatitis the authors concluded "silk clothing is unlikely to provide additional benefit over standard care in children with moderate to severe eczema" [15]. Although, such claims made by Lilysilk may not be as important for cooling sleepwear, this example speaks to the misleading information that can be provided by brands as they market their products.

# 4.0 Sleepwear/bedding brands that focus on sleepwear for hot sleepers and those who experience night sweats

#### 4.1 Cool Girl

Cool Girl appears to sell their branded sleepwear through retailers such as Amazon and other stores (e.g., <u>Cloud Nine Pajamas</u>). They state that their sleepwear "wicks moisture for a cool night's sleep". On their Facebook page they state that they have "technology-based sleepwear that wicks moisture and keeps you cool, dry and comfortable." (<u>Face Book Cool</u> <u>Girl homepage</u>).

Cool Girl also make a number of other statements about how their sleepwear performs to allow people to "sleep cool and comfortable with Cool Girl sleepwear". They indicate that the moisture wicking performance properties of their fabrics will not be lost due to laundering as their "moisture-wicking yarns are embedded in the garment so the wicking technology never washes out" (Why Cool Girl?). They also have statements related to rapid drying of their sleepwear, odour control and the softness of their garments in the following statement:

"Sleep in ultimate comfort in this sleepwear, our styles feature moisture-wicking fabric that eliminates odor and dries 4x faster than cotton, with a soft luxurious feel" (Why Cool Girl?)

Cloud Nine is a company that sells Cool Girl sleepwear. In relation to some of the products which are sold through their store, claims to moisture wicking and coolness and keeping dry are made: "the moisture wicking material will keep you cool dry and asleep!" (PJ Tee/Capri Knit Siesta Key); or the "lightweight fabric that is perfect for those hot sleepers! Keeping you cool and dry all night long!" (PJ Tee/Capri Key Biscayne). This type of language is similar to that used in the advertisement of garments on Amazon: "The Cool Girl brand keeps you cool, dry and comfortable throughout the night, our wicking fabric ensures a great night sleep." (Keep it basic cooling tank with back vent slit sleep top").

The fibre content of Cool Girl sleepwear is not clearly stated on Amazon. However, on the Cloud Nine website the fabrics are composed of 58% rayon, 37% polyester and 5% spandex (<u>PJ</u><u>Tee/Capri Knit Siesta Key</u>), and another is similar, although with a higher rayon and lower polyester content at 64% rayon, 30% polyester and 6% spandex (<u>PJ Tee/Capri Key Biscayne</u>).

Essentially, although these types of claims are very common among many of the sleepwear brands, there is no test data provided that supports the claims of moisture wicking, keeping cool and dry. How the yarns are knitted within the fabric construction is also not clear. However, the combination of hydrophilic cellulosic fibres such as rayon and hydrophobic synthetic fibres such as polyester, can often lead to fabrics that effectively wick liquid moisture [16]. As well, having a lower proportion of water-loving rayon fibres may also speed up the drying process, compared to fabrics that have a higher proportion of cellulosic fibres.

#### 4.2 Cool-jams

Cool-jams provide a great deal of information on their website about sleep comfort. Along with sleepwear, Cool-jams also sell bedding such as blankets, sheets, pillows and mattress pads. Although, much of their bedding products include bamboo viscose which have proportions of cotton in them as well. However, their sleepwear in terms of pajamas, nightgowns and loungewear appear to be made all from their Cool-jams moisture-wicking fabrics. The fibre content of these Cool-jams sleepwear products is more difficult to discern from the information provided under their "product details" tab for each individual item. They state their nightgowns and pajamas have a "smooth, silky cotton-like feel" but do not specify the fibre content of the products. They do state that the products are made from "Cool-jams<sup>™</sup> wicking technology - absorbs moisture, keeps skin cool and comfortable all night long and eliminates body odor-causing bacteria" (e.g., women's moisture wicking short panel nightshirt with pockets). It also "dries 4x faster than cotton".

Cool-jams does provide information about their technology generally, in the section "What are Cool-jams" in their webpage "The Science Behind Cool-jams Sleepwear" they state that

their "sleepwear fabric is a specially designed polyester microfibre that has been engineered to feel like cotton". Furthermore, their "ground-breaking Cool-jams technology, with its super soft 'cotton-like' comfort and feel, offers the superior odor and bacterial control of [their] natural antibacterial treatment". It also reportedly "delivers unparalleled performance in moisture management and lasts 6 times longer than cotton fabric". To support the claims that their sleepwear "performs better than any other wicking sleepwear tested" they have included laboratory testing results from certified testing laboratories. On a graph, in comparison to four other sleepwear brands they have presented results of air permeability which they have called "breathability of fabric", overall moisture management rating (OMMC from the AATCC test method 195), as well as moisture wicking distance and dry rate. Their values are higher than all other brands, particularly for air permeability and OMMC rating. They did not, however, provide any information showing how absorbent the fabrics are, such as moisture regain. Compared to the brands which are composed of cellulosic fibres (Brands 1-3) they would have had a far lower value for moisture regain.

On their webpage called "<u>The Cool-jams Difference</u>" they have provided further information under subheadings such as "Super soft and comfortable", "Quick drying", "Feels like cotton", "Lightweight". In the section called "Wicks heat and moisture and dries faster than any brand tested" they state:

"Independent lab testing shows that Cool-jams sleepwear is more breathable, absorbs & wicks moisture faster and dries faster than cotton, poly/cotton or any other wicking sleepwear brand. In fact, Cool-jams has the highest overall moisture management rating of any other sleepwear brand tested. With our proprietary **100% poly microfiber MST fabric technology,** Cool-jams provide an incredibly effective way to deal with night sweats, hot flashes or other temperature regulation problems. Don't settle for inferior wicking products when you can sleep in Cool-jams Sleepwear."

Although, Cool-jams do provide information about the fibre content of their sleepwear in these statements about their sleepwear technology, this information is not provided when viewing a specific item on their website. On online stores such as Amazon their sleepwear are referred to as "polymicrofiber" (e.g., <u>Moisture wicking Kristi capri pajama set for travel and hot nights</u>) or "100% polymicrofiber" (e.g., <u>Moisture wicking short sleeve button front pajama set</u>).

#### 4.3 CoolRevolution

CoolRevolution is another brand that produces sleepwear for people who experience night sweats or are hot sleepers. They state that they make "cooling sleepwear for hot sleepers" (<u>CoolRevolution</u>). Their pajamas are "designed to help women with night sweats get a more comfortable night's sleep. The naturally cooling, silky, soft fabric wicks away sweat, and dries quickly to help improve your sleep" (<u>CoolRevolution</u>). Their "pajamas are designed to help women going through menopause and perimenopause not only sleep better, but also feel better... ... They are the perfect solution for women with night sweats" (<u>CoolRevolution</u>).

Not only do they refer to cooling and moisture-wicking properties of bamboo viscose fibres, but they also imply that their fabric technology is antibacterial:

"CoolRevolution<sup>™</sup> was created to help women who are hot sleepers and have night sweats get a cooler night's sleep. The solution is in the design and in the fabric. CoolRevolution PJs are made of sustainable, bamboo fabric. Because it's a natural fiber, it doesn't trap heat like most polyester and synthetic fabrics. Bamboo is naturally cooling, moisture-wicking and antibacterial" (<u>CoolRevolution</u>).

In their "details and care" sections of various sleepwear items, the fibre content appears to be the same. That is, 66% rayon from bamboo, 28% cotton and 6% spandex. They also state that the items are made from a "moisture-wicking, breathable fabric," (e.g., <u>Cooling pajama tank and shorts set</u>). Their <u>women's cooling t-shirt for hot sleepers</u> and their matching <u>cooling pajama shorts for women</u> were reviewed in an article for *The Strategist* [17].

They do state that "no pajama can take away your night sweats, but we hope you'll find CoolRevolution<sup>™</sup> sleepwear makes going through life's changing a little more comfortable."

"You'll love how it feels soft and silky against your skin. Of course, it's cooling. After all, that's the whole point of CoolRevolution<sup>TM</sup>. Pajamas for women with night sweats." (<u>Women's cooling t-shirt for hot sleepers</u>).

#### 4.4 Dagsmejan

Dagsmejan is a brand that specialises in sleepwear for a "good night's sleep" where their sleepwear fabrics have "super soft touch as well as unique moisture-wicking and temperature management properties" (<u>Our-story</u>). Dagsmejan has worked with sleep experts and other scientists to develop their fabric technology. Their website is packed with technical information about sleep and their fabric technologies. They state that "Dagsmejan is scientifically proven to boost sleep comfort" and they have four patented technologies: Nattwell<sup>TM</sup>, Nattcool<sup>TM</sup>, Nattwarm<sup>TM</sup> and Nattrecover<sup>TM</sup> which comprise their sleepwear. The two technologies, Nattwell<sup>TM</sup> and Nattcool<sup>TM</sup> appear to be the technologies that are produced for people who experience night sweats.

They state that their sleepwear technologies have "integrated moisture-wicking zones combined with evaporative cooling help you to beat the night sweats with this sweat wicking pajamas t-shirt. 4x better moisture management than cotton." Their sleepwear in the "Balance" line appear to be made from Nattwell<sup>™</sup> fabric, which is composed of 95% high-tech micromodal from beechwood/ 5% spandex. Whereas, their sleepwear in the "Stay Cool" line is made from their Nattcool<sup>™</sup> fabric which is composed of 92% microlyocell from eucalyptus/ 8% spandex.

On their website they have pages which provide information about <u>sleep problems during</u> <u>menopause</u> and <u>hot flashes</u>. They provide three tips for helping combat hot flashes during the night. In their third recommendation they refer to the types of sleepwear that may help (or hinder) dealing with hot flashes:

"Menopause pajamas for hot flashes: most nightwear is not designed for our physiological sleep needs are not apt at meeting our particular needs when impacted by hot flashes. Natural fabrics often get soaked and then become wet and uncomfortable. Synthetic fabrics trap in the heat and the sweat and we overheat even more."

Their Nattwell<sup>™</sup> fibres rely on the hydrophilic properties of regenerated cellulosic fibres, but they report that the outside of the fibre has been modified to make it hydrophobic:

"Extensive research allowed us to enhance the MicroModal fibre—the core remains moisture absorbing, while the outer layer is adapted to make it water resistant and to repel moisture. This is what gives the Balance sleepwear collection revolutionary moisture management and temperature regulation properties. A moisture wicking pajamas that transport moisture away from your skin quickly, whilst cooling you down with evaporative cooling, for the optimal sleep temperature" (Nattwell<sup>TM</sup> technology).

When describing their Nattcool<sup>™</sup> technology they state that it is:

"8x more breathable than cotton as millions of nano capillaries lead excess heat away from the skin. If you start to sweat parts of the sweat is absorbed in the core of the fibres cooling you down through evaporative cooling. Thanks to the extraordinary fast drying times and the inherent moisture wicking properties of NATTCOOL<sup>TM</sup> you never feel wet" (Nattcool<sup>TM</sup> technology).

#### And that:

"NATTCOOL<sup>™</sup> has shown exceptional moisture management and breathability compared to other natural fibres such as cotton and bamboo as well as synthetic fabrics. That's what makes it the most cooling pajamas you can imagine!" (Nattcool<sup>™</sup> technology)

In their product information they often make comparisons of their fabrics with fabrics of other fibres such as it is "softer than silk, cooler than linen and better moisture management than cotton". Their sleepwear fabrics are "8x more breathable than cotton" and "quick drying –dries in 1/3 of the time of cotton" and "releases water vapour 60% better than cotton" (<u>Stay Cool Women</u>).

There is a lot of information to unpack on the Dagsmejan website. On their webpage entitled "The best temperature for sleep" they have a section on "why what we wear matters" which discusses "temperature regulating pajamas":

"To keep the best temperature for sleep we need to wear the right clothing at night. These are the 4 factors to look for:

- Temperature regulation: a breathable pajamas is critical as this helps to release excess heat so that we don't overheat and start to sweat. We also don't want to become too cold however as we then can start to shiver which also disturbs our sleep quality. Natural material tends to be more breathable than synthetics.

- Moisture management: we all sweat but if our sleepwear gets damp or soaked we can easily get cold and start to shiver. A sweat wicking pajamas helps to make sure that sweat is wicked away from the skin. However, you also want to makes sure that your sleepwear allows for evaporative cooling, as the moisture is released to the air your skin is also cooled down. Lightweight, natural materials are the best option for a combination of moisture wicking and evaporative cooling.

- Fit and comfort: as we move over 40 times every night in big and small movements we want to make sure that our sleepwear moves with it. It should not restrict you during the night nor bungle up. Look for a comfort design. The most comfortable pajamas should be like a second skin.

- Super soft touch: during the night the blood flow in our skin increases making us more sensitive to touch. Look for flat, ergonomic seams and a tagless design for a minimum of friction and rubbing at night." (The best temperature for sleep)

#### 4.5 SHEEX

SHEEX is a sleepwear and bedding company that was inspired by athletic wear. Therefore, the fibre content of SHEEX sleepwear is made predominantly from polyester. For example, their <u>women's keyhole sleep tee dress</u> is made of 87% performance polyester/ 13% spandex that was reviewed for an article in *The Strategist* [17] and the <u>women's P.J. shorts</u> which was reviewed in an article on cooling pajamas by *Insider* [18].

SHEEX sleepwear is made from their "Ridiculously Soft®" performance fabric:

"Our sleepwear is made from the same ridiculously soft SHEEX® performance fabrics as our sheets, providing unparalleled breathability and moisture wicking to maintain your body at its ideal sleep temperature while resisting odors."

"Our Ridiculously Soft® Performance fabrics will help put an end to over-heating and other sleep-disrupting temperature fluctuations. Start getting the great night's sleep your body needs to perform at its peak."

They state that SHEEX® fabrics "transfer heat up to 10x more effectively than traditional cotton" and "wick moisture, are wrinkle free and ridiculously soft®."

In information about how their SHEEX fabrics perform they provide the following information in their "How SHEEX fabric perform" section:

"SHEEX® fabrics have been engineered with SLEEP•FIT® Technology that wicks moisture away from your skin through capillary action ensuring advanced breathability and heat transfer while providing a cool-to-the-touch feeling. This is critically important for sustained comfort during sleep but also in terms of enabling the body to cool itself as rapidly as possible so you can fall asleep fast. SHEEX Performance Fabrics hold a distinct advantage over traditional cotton bedding because they are scientifically proven to keep you cooler - therefore ensuring a more restful and restorative nights sleep." (How SHEEX fabrics perform)

Again, much like the other brands which focus their business on finding sleepwear solutions for women going through menopause and others who experience night sweats their website is packed with technical information about the role of sleepwear on moving moisture, cooling and enhancing overall sleep quality.

# 5.0 Sleepwear/bedding brands with only some products advertised for hot sleepers and for people who experience night sweats

#### 5.1 Cloud Nine Pajamas

Cloud Nine sell sleepwear from multiple brands, some of which are covered elsewhere in this report (e.g., Cool Girl, Yala). They also produce their own sleepwear lines: Scarlett Ellie and Georgia Rylan. The fibre content of their Scarlett Ellie line of sleepwear appear to all be 96% bamboo viscose and 4% spandex. Whereas, based on the information provided about the

Georgia Rylan line of sleepwear the fibre content of the fabric is 95% bamboo (presumably viscose from bamboo) and 5% spandex.

On the Cloud Nine Pajamas website there is a section called "Moisture Wicking" which directs consumers to pajamas and nightgowns that have moisture wicking properties. They also have another section called "About Moisture Wicking", where they state that "wicking sleepwear was designed to give you a good night's sleep, despite hot flashes and night sweats". They provide a brief explanation as to what can cause night sweats and conclude that "no matter the cause, you know that night sweats can break up a good night's sleep, leaving you damp, freezing, and restless. Your sleepwear, as well as your bedding can get wet, making a return to dreamland only a distant possibility." They further explain that "technically, the moisture wicking material is woven so that it pulls moisture away from the body and spreads out the perspiration allowing it to dry more quickly. The fabric is designed so that each molecule draws moisture away from the neighboring molecule spreading moisture over as wide a surface area as possible, which in turn speeds up the evaporation process." There have been some references to odour control made by other brands, information on the Cloud Nine website also gives a hint that some of their sleepwear items may have odour control properties: "many of these products also have an odour free treatment embedded which virtually eliminates odour". Although, it is unclear which items do have odour control in the product information. They conclude that a user of their sleepwear will be "left with dry, warm, luxurious sleepwear!" (About Moisture Wicking).

As already stated, the Cloud Nine labels use bamboo viscose in their sleepwear lines. They state that:

"Bamboo is a natural wicking fibre. Bamboo fabric is used in some sleepwear because of its absorbency and softness. Bamboo is sustainable resource and the environmental impact is much less than with other fabrics." (About Moisture Wicking).

Examples of the wording used in two of their Georgia Rylan styles are:

"A soft and breathable short set to wear all year long! Bamboo will keep you cool and dry if you are a warm sleeper!" (Georgia Rylan: PJ tee/short bamboo).

"This classic set is so luxurious, so soft and also breathable!" "The bamboo moisture wicking fabric will wick away moisture and keep you cool dry and asleep!" (Georgia Rylan: PJ Button Up Bamboo).

One example of the wording used in a Scarlett Ellie style is:

"The bamboo fabric will keep your temperature regulated and allow you to sleep comfortably all night!" (<u>Scarlett Ellie: dress pockets long sleeve bamboo</u>).

#### 5.2 Cozy Earth

Cozy Earth produce bedding, bath and loungewear (which includes sleepwear) items. Cozy Earth have a range of sleepwear products which appear to be made from viscose (from bamboo) although they also have comforters that are made from silk (mulberry silk). One such product is the short-sleeved nightdress, and another the <u>short-sleeved bamboo pajama</u> <u>set in stretch-knit</u>.

Each sleepwear item is also accompanied with general statements that do not always match the actual product which is being shown. For example, regardless of the sleepwear item, there is a section called "Product details" with the statement "Made from 100% viscose from bamboo", whereas, when you click on "Product description" tab the product may be labeled as being 95% viscose from bamboo and 5% spandex. In the general product detail section the statement that Cozy Earth items are made from "breathable and moisture-wicking fabric that feels degrees cooler than cotton" followed by "never worry about hot flashes again!" is given. As the products that are advertised for sale do no align with the information provided in the Product Description section it could be somewhat misleading, and some of their statements may be exaggerating the true benefit of their sleepwear.

In terms of the performance properties that may be helpful in sleepwear for hot sleepers the following description was used for the women's pajamas:

"feature enhanced breathability and temperature regulation" and they are "ideal for hot temperatures" (Women's long sleeve bamboo pajamas in stretch-knit)

#### 5.3 Eberjey

Eberjey is a lingerie and sleepwear company that does not focus on cooling sleepwear. A key textile property they promote in the fabrics used in their sleepwear is softness. However, the brand has been included in articles on sleepwear for "hot sleepers". For example, the Gisele Long PJ Set was reviewed by the Good Housekeeping Institute [19]. This product is made from Tencel<sup>™</sup> (95% Tencel<sup>™</sup> modal and 5% spandex) although the brand does not obviously promote cooling sleepwear, their fabrics from Tencel<sup>™</sup> modal fibres are said to the "temperature-regulating" sustainable fibres:

"Our luxurious, temperature-regulating knit fabric drapes and falls in all the right ways, enveloping the body in comfort" (<u>Gisele Long PJ Set</u>)

#### 5.4 Ekouaer

Ekouaer is a loungewear brand. An <u>Ekouaer pajama set</u> was reviewed in a recent *Good and Well* cooling pajama's article [20], although from the link provided within the article there appears to be no reference to the cooling properties of the pajamas. "The breathable fabric makes you stay warm but not too hot" (<u>Ekouaer contrast piping pocket patched pajama set</u>). In another product the following is stated:

"made of light and breathable, good perspiration capacity, keep skin natural breathing, cool fabric, avoid uncomfortable sweating, let you feel completely relaxed, enjoy a good night" (Ekouaer tops and capri pants 2 piece pajamas set).

#### 5.5 Ettitude

The Ettitude sateen cami was reviewed in a *Well and Good* article on cooling pajamas [20]. The item is made from Ettitude's CleanBamboo<sup>™</sup> fabric which is 100% bamboo rayon. On their website Ettitude states that CleanBamboo<sup>™</sup> is "made from 100% bamboo, it's silky-soft, breathable, cooling and sustainably made." (Ettitude.com). On selected product information about the "silky-soft cami" they state that the garment is "made from our sustainable CleanBamboo<sup>™</sup> fabric, designed to keep you cool and comfortable". There are also statements about the cooling properties, softness and a comparison of their fabric to polyester:

"Soft yet durable bamboo designed to transition from bed to brunch with ease"

"Hypoallergenic fabric made for sensitive skin and to keep you cool" "Luxuriously-soft vegan silk that won't cling to your body like polyester" (see <u>Sateen</u> <u>Cami</u>)

#### 5.6 GYS Brand

GYS Brand do not appear to have their own website and are primarily sold online through Amazon. They have a number of sleepwear products and not all claim to be related to helping with night sweats. Some of their products that do may in part be associated with the sleepwear design (e.g., sleeveless), such as the <u>GYS women's soft bamboo chemise nightgown</u> or the <u>GYS women's bamboo nightgown sleeveless soft nightdress</u>. Both of these nightdresses are composed of 95% viscose from bamboo and 5% spandex. Examples of claims made in some of the selected advertisements on Amazon are:

"Upgraded bamboo material, silky soft, lightweight, highly stretchy and breathable, moisture-wicking, enough cool to beat sweats, save you from hot flashes and heat waves" (GYS women's soft bamboo chemise nightgown).

"This Sleeveless Nightgown is made of 95% Viscose from Bamboo and 5% spandex, the perfect combination of night clothes since it's breathable and won't make you feel warm or sweat. It's cool against your skin and lightweight." (<u>GYS women's bamboo nightgown sleeveless soft nightdress</u>)

"Do you feel hot at night or just can't sleep without a shirt? This is your perfect choice, it will make you feel cool and comfortable so you can sleep and wake up 100% refreshed and ready for today's new challenges. Buy now with confidence." (GYS women's bamboo nightgown sleeveless soft nightdress)

#### 5.7 Joyaria

Like GYS, Joyaria also do not appear to have their own website and their products are mainly sold through Amazon and other online retailers. Their pajamas have been reviewed in the lifestyle section of *People* online [21]. The pajamas the People article links to states that these pajamas are composed of 95% viscose and 5% "other fibres" and that they are "perfect for ladies with night sweats" (Women's soft bamboo pajama sets button down long sleeve PJ).

Some other descriptions for Joyaria styles that are sold on Amazon include:

"Moisture Wicking: With 95% bamboo viscose and 5% Spandex material, this pajama set is perfect for women suffering from hot flashes, night sweats and sleeplessness during summer and hot weather (<u>PJs set for women bamboo soft short sleeve long pants</u> jersey)."

"Soft Material: The pajama set is made of 95% viscose (made from bamboo), 5% spandex, which is slick, lightweight and durable. You can hardly feel its existence while wearing." "Moisture-wicking Tech: Smooth fabric of the PJs is cool and refreshing, perfect for hot weather. Definitely essentials to people who sweat a lot" (women's bamboo short sleeve pajamas summer PJ set).

#### 5.8 Karen Neuburger

Karen Neuburger® (KN) has a range of loungewear products mostly sold through Amazon. The company does not explicitly make claims that their sleepwear items are appropriate for hot sleepers or people who experience night sweats. However, they do market some of their sleepwear products as having the "KN cool signature moisture wicking technology will keep you cool and dry all night". Examples are the <u>women's short sleeve top and cozy bottom</u> Bermuda short pajama set and women's top and Bermuda pant bottom pajama set.

#### 5.9 Latuza

Latuza is a sleepwear brand that produces pajamas, nightshirts and robes. Although, they do stock some that are 100% cotton (e.g., their flannel sleepwear), it appears that their main emphasis is on fabrics made from bamboo viscose. Furthermore, it is their bamboo viscose (95% bamboo viscose/ 5% spandex) fabrics that are used in any product specific claims about hot flashes. For example,

"Made with breathable and moisture wicking bamboo viscose, which feels soft and comfy for hot flashes" (Women's floral nightgown bamboo viscose nightshirt).

However, when browsing through their collections, most of their sleepwear items made from bamboo viscose do not make specific reference to night sweats or hot flashes. The softness of the material appears to be their most dominant feature.

Nonetheless, they have a webpage on their site which is entitled "<u>Cool bamboo pajamas for</u> <u>night sweats by Latuza bamboo collection</u>" where they make claims about their bamboo viscose fabrics and the benefit of wearing their bamboo viscose pajamas if you experience night sweats.

"Bamboo viscose pajamas are, quite obviously, made out of bamboo viscose fabric. This type of fabric is extremely absorbent and breathable. Compared to polyester and cotton fabric, bamboo viscose fabric can wick away excess moisture. By wicking away moisture—whether you are awake or whether you are asleep—bacteria can't grow as easily on your skin. In other words, your skin will be healthier. You will stay fresher. And your skin will have less of an odor." (Bamboo viscose pajamas: the basics)

"Ultimately, bamboo viscose pajamas are made of a lightweight, breathable fabric that can serve those who have sensitive skin or experience night sweats. They are ultra soft, breathable, and extremely comfortable to wear. These pajamas can ensure that you maintain consistent body temperature—even on the hottest days or months of the year." (Bamboo viscose pajamas: the basics)

On their "about bamboo" page they state:

"What makes bamboo viscose so special? It's temperature-regulating properties keep you feeling cooler in summer and warmer in the winter. It's breathable, naturally antibacterial, and yet feels luxuriously soft and comforting to even the most sensitive skin. With this moisture- wicking miracle you'll say goodbye to night sweats, sleep better and wake up feeling fresher than ever." (About Latuza)

Latuza pajamas do have many positive reviews on Amazon, some of which the customers have specifically mentioned not being as bothered by night sweats.

#### 5.10 Sleepytime pajamas

Similar to GYS and Joyaria, Sleepytime is another brand that does not appear to have its own website. Sleepytime also sells through many online platforms such as Amazon. Sleepytime does however appear to explicitly market some of their sleepwear lines as being for women who are experiencing menopause, with their <u>hot flash menopause relief PJs, V neck</u>. These pajamas are made from:

"premium bamboo material" that "boasts many positive features including excellent moisture wicking ability to keep you cool and comfortable throughout the night." The pajamas are also "lightweight, breathable and soft to wear [which] makes them the perfect sleepwear to give you a great night's sleep".

In fact, quite bold claims are made about Sleepytime hot flash menopause relief pajamas as they are the:

"PERFECT MENOPAUSE SOLUTION - The ideal all natural menopause relief from symptoms such as hot flashes, night sweats and related sleep problems. No subscriptions or alternative medicines - just comfortable, breathable high quality pajamas to help you sleep peacefully again."

Followed by:

"ALL NATURAL REMEDY - You've finally found the healthy and affordable menopause remedy you've been searching for. Highly effective alternative to menopause vitamin complex supplements, bedding pads, support books, cooling pillows and herbal teas."

There are a number of Sleepytime pajamas and sleepwear items that can be found on Amazon which make these claims (e.g., <u>Night sweat moisture wicking sleepwear - summer style</u>, <u>women's sleepwear tops with capri pants pajama set</u>).</u>

#### 5.11 Softies

Softies are a brand that produces loungewear, sleepwear and robes. They have a Wellness Fabric® technology that appears to have been developed with the search for the "best pajamas for night sweats or hot flashes" in mind (<u>Moisture-wicking sleepwear that keeps you cool</u>).

According to their website Softies explains the benefit of lower temperatures to sleeping well. They cite information from Sleep.org and explain that one way to help regulate your environment to lower ones body temperature for sleep is by "choosing sleepwear that keeps you cool at night". They state:

"Softies' moisture wicking pajamas are perfect for women coping with menopause, perimenopause or are just hot sleepers. If hot flashes or night sweats keep you from getting a good night's rest, Softies' cooling, breathable pajamas will lull you to sleep effortlessly." (Wellness Fabric®)

Their Wellness Fabric® uses Drirelease® technology:

"Drirelease® is the best fabric for night sweats, offering superior moisture wicking and faster drying compared to other fabric technologies on the market. In addition, without chemicals to wash out over time, drirelease® fabric ensures long-term, eco-friendly performance." (Wellness Fabric®)

Other statements which are made on the Softies website related to their Wellness Fabric® are:

"Sleep Cool: Our innovative moisture-wicking fibers dry four times faster than cotton, enhancing breathability and comfort."

"Sleep Clean: Protected by antimicrobial technology, your tagless garment stays fresh, comfortable and clean in between washes."

"Live Healthy: Wellness properties are permanently spun into our fabric's DNA for long-lasting and eco-friendly health benefits." (<u>Moisture wicking fabric that keeps you</u> <u>cool</u>)

"Softies' luxurious, high-tech sleepwear features our signature Wellness Fabric® that regulates body temperature and wicks away moisture for a better night's sleep." (Softies PJ Sets)

In fact, they say their Wellness Fabric®:

"takes sleep comfort to the next level" as it is "designed with you in mind, our sweat wicking garments keep excess moisture at bay, enabling you to face the day wellrested and refreshed." (Wellness Fabric®)

They provide information about drirelease® performance fabrics and a link to the drirelease® website:

"The drirelease® performance fabric contains a blend of synthetic water-repelling and natural water-absorbing fibers. This unique combination pulls moisture and perspiration away from the skin and pushes it outside the fabric, where it quickly evaporates." (Wellness Fabric®)

Wellness Fabric® also has antimicrobial technology that "resists bacteria, stains and odors". In fact, they refer to this as "sleep clean" as it is "protected by antimicrobial technology" (see below product description: <u>Cali - scoop neck tank shorty</u>)

Softies' fabric appears to be Cool-Clean Tech The fibre content used in their sleepwear items are: 81% polyester, 14% lyocell and 5% spandex (e.g., <u>Tully - Vneck capri PJ with tulip hemlines</u>, <u>Scoop Neck Tank Shorty PJ Set</u>).

Other information that is provided within the product description is provided emphasizing wicking and fast drying as well as their antimicrobial properties:

"Moisture-wicking, fast-drying and incredibly comfortable Softies Women's Scoop Neck Tank and Shorts Set with Contrast Piping delivers a luxury experience plus high-tech performance... ...Crafted with both antimicrobial 24/7 cleanliness protection and drirelease® Lyocell fibers, this set will keep you cool and comfortable all night long. Best of all, this breezy bundle envelops you in extreme softness, complete with a tagless, no-scratch label. Jammies never looked so cute while feeling this cozy!" (<u>Cali</u> - scoop neck tank shorty).

#### 5.12 This is J

This is J is a Canadian brand that produces creative lougewear, pajamas and accessories from bamboo viscose fabrics. In the section on their website about their fabrics, they have a FAQ where they describe their bamboo viscose fabric properties and reasons why they choose this type of fabric for their sleepwear lines:

Question: "Why do you like working with bamboo?" "For lots of great reasons! Here are a few: It is inherently anti-bacterial, anti-fungal, odour resistant, moisture wicking and durable. Creates an unbelievably soft fiber and washes well." (Questions about fit, feel and fabric)

Question: "What makes your fabric moisture-wicking?"

"The fibrous quality of our signature fabrics create small fiber 'hairs' within the yarn that pull moisture away from your skin to help regulate body temperature. Sometimes mistaken for piling, these fibres are actually the essence of our fabric's amazing wicking capabilities. We finish the fabric with a gentle heat set during our dyeing process to keep the appearance of the fibres to a minimum, but they can be more visible on some colour fabrics that others. Just remember, they are there for a good reason - to keep you unbelievably comfortable!" (Questions about fit, feel and fabric)

This is J's sleepwear styles are "made from our signature ultra-soft and moisture-wicking fabric blend" (see <u>Henley Harem Set</u>) which is composed of 93% viscose from bamboo and 7% spandex.

#### 5.13 Wiwi

Wiwi was a brand that was reviewed in an article in the Lifestyle section of *People* on cooling sleepwear that was under \$35 (<u>Belfiore, 2021</u>). They appear to sell online through Amazon. Their nightgown is 95% bamboo viscose and 5% spandex. In a description of the product they state that "This full slip/ sexy nightwear/ dress sleepwear/ cute chemise/ slip lingerie for women is silky soft and skin-friendly. Super lightweight and breathable, help you sleep more soundly without annoying sweats." (<u>Women's Bamboo Nightgowns Soft Full Slip Dress Stretchy</u> Chemise).

In the description on another item sold on Amazon, the company states that the fabric is "moisture wicking" and it's:

"Enough cool to beat sweats, save you from hot flashes and heat waves. This bamboo material pajama set let your skin breathe all night and helps you sleep more soundly" (Soft bamboo PJs nightwear short sleeve top with shorts).

And another it is stated to be a "cool fabric":

"Bamboo fabric does great job at moisture wicking and durability. Enough cool to beat sweats, save you from hot flashes and heat waves. Keep you easeful while sleeping at night, that's also ultra smooth against your skin." (Long sleeve sleepwear laced V neck top and pants).

#### 5.14 Yala

Yala is a sleepwear company that specializes in viscose made from bamboo. Their main claim related to performance of their fabrics are stated in the section on "feel and function":

"There are many benefits to wearing and sleeping in bamboo fabric. It is silky soft to the touch, lightweight, and breathable. It is also temperature-regulating and moisture-wicking, keeping you warm in the cold, cool in the heat, and dry where other fabrics fail. Our bamboo fabric is also naturally high in UPFs, protecting your skin from the sun." (About Yala, para 14)

The <u>Savannah lace short bamboo pajama set</u> was reviewed in a *Good and Well* article on cooling pajamas [20]. On their website they state that "like a second skin, our bamboo viscose jersey provides incredible softness, breathability, and sun protection", however, no further reference to cooling aspects of this set were provided.

## 6.0 Brands that produce many types of apparel item, but have some sleepwear items or lines for hot sleepers

#### 6.1 Athleta

Athleta have two sleepwear lines that may purport benefits of cooling technology. One of their Nighttime Bliss sleepwear items was selected and tested by the Good Housekeeping Institute [19]. While the reviewers stated that the Nighttime Bliss Sleep CYA Tee did not wick as well as others products reviewed, the user testing indicated the fabric felt cool at night. On Athleta's website, the Nighttime Bliss sleepwear does not appear to be specially marketed as having cooling properties. Rather, the fabrics are "buttery-soft" and the fabric is lightweight and "drapes like a dream". Under the fabric and care section however, Nighttime Bliss products are described as being "breathable" because "airflow moves easily through the garment". (see "Fabric + Care" in Nighttime Bliss sleep tee).

Sleepwear that appears to be more directly marketed as having cooling benefits is Athleta's Cool Calm style. The Cool Calm style of sleepwear is described as being for "lounging, relaxing, and a good night's sleep" while the feel of the fabric is "cooling and luxurious". Cool Calm styles are "cool-to-the-touch and designed to release body heat to keep you comfortable all night long". Furthermore, they add that "this silky-smooth fabric is ultrabreathable to help evaporate sweat while you sleep" (see "Product Details" in <u>Calm Cool</u> <u>Cami</u>).

The Calm Cool line of sleepwear is made from cupro rayon (presumably 100% cuproammonium rayon). Like the information provided in fabric and care section in their Nighttime Bliss styles they state that Calm Cool fabric is "breathable: Airflow moves easily through the garment". (see Fabric + Care in <u>Calm Cool pant</u>).

#### 6.2 Chill Angel

One item from Chill Angel was reviewed for an article on cooling pajamas for The Strategist (Iorio Adelson, 2020). Although the sleepwear by Chill Angel doesn't appear to be specifically targeted at people who are hot sleepers, some information provided in the description of the product online does state the fabric has "temperature balancing properties keep your body temperature regulated and also wicks moisture so you can sleep noticeably better" (<u>RNR</u>

<u>Crew</u>). Another item with "temperature balancing and moisture wicking properties will keep your body dry and comfortable, no matter what the climate conditions are" (<u>Reverie Crew</u>).

#### 6.3 Fishers Finery

Fishers Finery is a brand that produces and sells a number of apparel items, sleepwear among them. Fishers Finery does not appear to be directly marketing to consumers who experience night sweats. However, it has been mentioned as an option in media articles on sleepwear for nightsweats (e.g., Nolan-Pleckham, 2021).

Fishers Finery have a proprietary fabric called EcoFabric<sup>™</sup> which appears to be used in their sleepwear styles. This fabric is 70% bamboo viscose, 25% organic cotton and 5% spandex. They claim their EcoFabric<sup>™</sup> has "moisture wicking properties" and their "EcoFabric<sup>™</sup> keeps you cool and comfortable year round" (Women's original EcoFabric<sup>™</sup> full length pajama set). They also have other trademarked fabrics with the EcoFleece<sup>™</sup> and the EcoFlannel<sup>™</sup> for winter pajamas although there are statements such as "EcoFlannel<sup>™</sup> keeps you cool and comfortable all year round" are still made under the "moisture wicking properties" bullet in the overview section of the product description (see women's EcoFlannel<sup>™</sup> full length plaid pajama set).

#### 6.4 Hotouch Brand

Hotouch is a brand that sells a number of different types of apparel items, and therefore does not specialize exclusively in sleepwear. The majority of their sleepwear items that are sold through Amazon are not advertised as managing night sweats. However, there are some, for example, <u>Hotouch women's short sleeve lace trim scoopneck nightshirt</u> is advertised as being made from modal (although the exact fibre content is not stated on Amazon's website). Bullet points that give a brief description relate to the softness of the material include "superior material [is] soft and comfy and skin friendly" and it is "made using soft modal material, stretchy, soft, lightweight, this sleep dress for women feels great on the skin and also makes for supremely comfy loungewear"

Furthermore, users will "stay perfectly cool":

"even on those extra warm nights, these ladies' nightgowns keep you nice and cool thanks to the lightweight fabric. Our nightdresses are designed to promote maximum airflow to keep those uncomfortable night sweats at bay" (<u>Hotouch women's short sleeve lace trim scoopneck nightshirt</u>)

#### 6.5 Lilysilk

Likysilk specialises in luxury garments and bedding produced from mulberry silk. Their sleepwear range of women's pajamas begin at \$200. They make general claims about their products as being:

- <u>Skin-friendly</u>
- Anti-allergy
- <u>Breathable</u>
- Light and soft
- Long lasting
- Moisture wicking
- Quality sleep

On their website they state that silk is antibacterial:

"Study has shown that silk possesses certain traits such as its naturally hydrophobic nature and its inherent antimicrobial, antibacterial, and antiviral properties. The use of commercially available fabrics for improvised face coverings has also shown that silk possesses some capacity as an antimicrobial barrier when used alone for the fabrication of face coverings." (Natural Traits of Silk, para 2).

"Silk is naturally hypoallergenic. As a natural fiber emitted by silkworms, it mainly consists of two proteins, sericin and fibroin. Sericin is naturally infection resistant, so it can keep away dust mites, mold, bacteria, and other common allergens."

"Silk is also free of any potential irritating chemicals and toxicants, so it can be worn safely even for people with sensitive skin. It's no risk of causing eczema flare-up, skin rashes or dreaded stuffy nose that allergy sufferers cannot be more familiar with. BTW, most silk we use is OEKO-TEX certified."

In another claim, linked to "moisture wicking" on their homepage, but titled "Breathable/Thermal Regulating" once the link is accessed the following statement is made:

"Silk is a very breathable fabric making heat escape through it, and because of its insulating characteristics, you will get a constant stream of fresh air in without having to worry about feeling cold. It's like having a natural thermostat embedded in this luxurious fabric making it the best all-season textile, which is especially ideal for women undergoing menopause and suffering from nightly hot flashes."

Silk does have a high moisture regain of 11% and the knit construction of their <u>t-shirt style</u> <u>silk-knit sleep dress</u> fabric should lend itself to high air permeability and moisture vapour permeability.

#### 6.6 Lunya

Like Lilysilk, Lunya is another brand that stocks many silk garments. In terms of cooling sleepwear, Lunya explicitly has a category for "<u>hot sleepers</u>". The statement they make on this webpage is:

"Natural cooling properties, lightweight, refreshing. Designed for hot sleepers and the one-leg-over-the-covers crowd, these fabrics will keep you feeling dry and refreshed. No more sweaty sheets or ripping your socks off in the heat of the night."

"Our iconic Washable Silk for mixing or matching however you like. Our Mulberry silk is naturally thermoregulating, giving you that refreshing 'cool side of the pillow' feel all night long. Designed with an easy, relaxed, and flattering fit, it's the perfect layer beneath your cozy robe - or to slip on solo." (<u>Washable Silk Tank</u>)

They also have a variety of options which differ in fibre content and fabric structure on their website. For example, they have the <u>airy cotton sleep shirt dress</u> which is 100% cotton (long US cotton fibre) and made from a poplin (woven) fabric; the <u>washable silk tee set</u> which is 100% silk and, although not stated, appears it could be a satin woven fabric; and the <u>washable silk set</u> which is a tank top and shorts of 100% silk, presumably satin weave.

In the "product details + care" of the two silk sleepwear items, they claim they are "thermoregulating to help maintain a comfy body temp" and the poplin cotton sleep shirt dress is "both breezy and lightweight" and the "super soft, super breathable [shirt's] oversized fit with pleating in back keeps you looking laidback, and feeling cool (temp and style-wise)".

Cotton fibres have a fine diameter and longer fibres tend to be finer still, this supports the claims of a soft handfeel. Cooldown Pima<sup>™</sup> fabric which is composed of 69% Pima cotton, 23% viscose, 8% polyester. They state that this fabric is "thermoregulating to help maintain a comfy body temp". They also state:

"Banish nighttime overheating with innovative Cooldown Pima<sup>™</sup>. An oversized fit silhouette to keep the fabric away from your body, it's designed with soft and breathable, U.S. sourced pima cotton. Infused with jade, this innovative fabric is smartly engineered to dissipate sweat and regulate humidity. Scientifically proven to keep you cooler than standard cotton, you can finally say goodbye to night sweats." (Cooldown Pima<sup>™</sup> short sleeved tee).

#### 6.7 Soma

Soma's <u>long sleeve notch collar PJ set</u> was recommended by Real Simple as their best longsleeved set of cooling pajamas in (<u>realsimple.com</u>). The brand has a signature fabric called Cool Nights® fabric. Their Cool Nights® fabric is claimed to be "made with lightweight rayon fibers that stay cool to the touch and keep the fabric from sticking to your body". In some other statements about their cooling material they state: "Made from our soft Cool Nights® fabric, it stays cool to the touch, so you stay cool and comfortable all night."

Most of Cool Nights® styles are 93% rayon and 7% spandex (e.g., <u>Pajama Shorts</u>, <u>Modern</u> <u>Sleepshirt</u>), although some other styles have a higher rayon percentage at 98% rayon with 2% spandex (e.g., <u>Long Sleepshirt</u>).

#### References

- [1] Collier, B. J.; Bide, M.; Tortora, P. G. *Understanding Textiles*, 7th ed.; Upper Saddle River: New Jersey, 2009.
- [2] Humphries, M. *Fabric Reference*, 4th ed.; Upper Saddle River: New Jersey, 2009.
- [3] Troynikov, O.; Wardiningsih, W. Moisture Management Properties of Wool/ Polyester and Wool/Bamboo Knitted Fabrics for the Sportswear Base Layer. *Text. Res. J.*, **2011**, *81* (6), 621-631. https://doi.org/10.1177/0040517510392461.
- [4] Wang, F.; Annaheim, S.; Morrissey, M.; Rossi, R. M. Real Evaporative Cooling Efficiency of One-Layer Tight-Fitting Sportswear in a Hot Environment. *Scand. J. Med. Sci. Sport.*, **2014**, *24* (3), 129-139. https://doi.org/10.1111/sms.12117.
- [5] Fibre2Fashion. "Just Right" Sleepwear with Outlast Technology. 2007.
- [6] Glovinsky, P.; Zavrel, E. Sleepwear with Lateralized Thermal Properties for the Treatment of Sleep Disturbance in Women. *Int. J. Cloth. Sci. Technol.*, **2018**, *30* (1), 62-72. https://doi.org/10.1108/IJCST-08-2016-0104.
- [7] Cimilli, S.; Nergis, B. U.; Candan, C.; Özdemir, M. A Comparative Study of Some Comfort-Related Properties of Socks of Different Fiber Types. *Text. Res. J.*, 2010, 80 (10), 948-957. https://doi.org/10.1177/0040517509349782.
- [8] Hardin, I. R.; Wilson, S. S.; Dhandapani, R.; Dhende, V. An Assessment of the Validity

of Claims for "Bamboo" Fibers. *Am. Assoc. Text. Chem. Color. Int. Conf. 2009*, **2009**, No. July 2015, 250-256.

- [9] Walter, N.; McQueen, R. H.; Keelan, M. In Vivo Assessment of Antimicrobial-Treated Textiles on Skin Microflora. *Int. J. Cloth. Sci. Technol.*, **2014**, *26* (4), 330-342. https://doi.org/10.1108/IJCST-12-2012-0078.
- [10] McQueen, R. H.; Keelan, M.; Xu, Y.; Mah, T. In Vivo Assessment of Odour Retention in an Antimicrobial Silver Chloride-Treated Polyester Textile. J. Text. Inst., 2013, 104 (1), 108-117. https://doi.org/10.1080/00405000.2012.697623.
- [11] Ricci, G.; Patrizi, A.; Mandrioli, P.; Specchia, F.; Medri, M.; Menna, G.; Masi, M. Evaluation of the Antibacterial Activity of a Special Silk Textile in the Treatment of Atopic Dermatitis. *Dermatology*, **2006**, *213* (3), 224-227. https://doi.org/10.1159/000095040.
- [12] McQueen; Laing, R.; Niven, B. Odor Intensity in Apparel Fabrics and the Link with Bacterial Populations. *Text. Res. J.*, **2007**, *77* (7), 449-456.
- [13] Ricci, G.; Patrizi, A.; Bellini, F.; Medri, M. Use of Textiles in Atopic Dermatitis: Care of Atopic Dermatitis. *Curr. Probl. Dermatol.*, 2006, 33 (February), 127-143. https://doi.org/10.1159/000093940.
- [14] Dermasilk. What is DermaSilk https://www.dermasilk.co.uk/why-dermasilk/what-isdermasilk.html (accessed Jun 30, 2022).
- [15] Thomas, K. S.; Bradshaw, L. E.; Sach, T. H.; Batchelor, J. M.; Lawton, S.; Harrison, E. F.; Haines, R. H.; Ahmed, A.; Williams, H. C.; Dean, T.; et al. Silk Garments plus Standard Care Compared with Standard Care for Treating Eczema in Children: A Randomised, Controlled, Observer-Blind, Pragmatic Trial (CLOTHES Trial). *PLoS Med.*, 2017, 14 (4), 1-23. https://doi.org/10.1371/journal.pmed.1002280.
- [16] Jhanji, Y.; Gupta, D.; Kothari, V. K. Moisture Management Properties of Plated Knit Structures with Varying Fiber Types. J. Text. Inst., 2015, 106 (6), 663-673. https://doi.org/10.1080/00405000.2014.934044.
- [17] Iorio Adelson, K. I Always Woke up Sweaty until I Tried These Cooling Pajamas. *The Strategist*. February 2020.
- [18] Guerra, J. 11 Cooling Pajamas for Hot Sleepers That Are Tired of Waking up Sweaty. Insider. June 2021.
- [19] Wu, G. 10 Best Cooling Pajamas to Keep Night Sweats at Bay. *Good House Keeping*. April 19, 2022.
- [20] Flinn, A. 13 Pairs of Cooling Pajamas, So You Don't Wake Up In a Puddle of Sweat. *Good* + *Well*. June 2022.
- [21] Gandara, M. Amazon Shoppers Say These Sweat-Wicking Pajamas "Feel Way More Expensive Than They Are." *People*. December 2021.