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Review

Psychological Aspects of Sensitive Skin: A Vicious Cycle

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Abstract: Sensitive Skin Syndrome (SSS) has been the subject of intense research in the past several years. Recent reviews confirm that about 40% of the population report moderate or very sensitive skin, and an additional 30% report slightly sensitive skin. Although certain phenotypes are more susceptible, anyone can suffer from SSS and this condition can manifest in all anatomic sites. A wide variety of environmental and lifestyle factors can trigger SSS symptoms of itching, stinging, burning, pain, and tingling. In order to avoid such triggers, the SSS individuals often alter their behaviors and habits such as restricting their daily activities, and modifying the use of everyday products that non-sensitive individuals take for granted. In addition, there is an association between SSS and some common psychological problems. Sensitive skin symptoms such as itching, stinging, burning and pain can result in sleep disorders, fatigue, stress and anxiety. Conversely, lack of sleep and stress from external sources can make the SSS sufferer more prone to the symptoms. This becomes a vicious cycle that impacts consumers' quality of life and well-being. We are beginning to understand the importance of the underlying causes that can impact skin conditions. However, in order to better understand the SSS individual, we need to also be aware of the psychological factors that can trigger and/or worsen this skin condition, as well as the psychological stresses the condition places on the individual.

Keywords: Sensitive Skin Syndrome; anatomic variations; stress; gender; menstrual cycle; genetics; dermatologic; sleep disorders; fatigue; quality of life

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1. Introduction

Sensitive Skin Syndrome (SSS) has been the subject of intense research in recent years. Anyone can suffer from SSS; however, there are certain characteristics, or host factors, that are more likely to be seen in SSS individuals. These include female gender, fair skin, higher susceptibility to sunburn and blushing, and skin phototypes I–IV [1]. Typically, there are no objective signs of skin irritation in subjects suffering from SSS. Rather the condition manifests as unpleasant sensations such as pruritus, stinging, burning, pain, and tingling sensations, in response to a wide variety of external and internal stimuli that normally should not provoke such sensations [2–4]. Due to the absence of consistent objective signs, such as redness or swelling, investigators have relied on a questionnaire-based approach to evaluate this condition. Several such studies have been conducted among populations around the world to evaluate the prevalence of SSS in the general population (reviewed in Farage, 2019 [5]). Chen et al.'s meta analysis representing 18 countries, and a total of 51,783 individuals showed around 71% of people self-reported SSS [6].

Sensitive skin can affect all anatomic sites including face, scalp, and the genital area [5,7]. As we will see in this review, this can have a significant impact on an individual's everyday life. Often the individual must cope with other dermatologic disorders in addition to the SSS symptoms. An individual with SSS must identify and avoid a wide variety of factors that can trigger their symptoms. In turn, the manifestation of SSS symptoms and can trigger psychological effects.

2. Physiological Contributors to SSS

A number of physiological differences have been identified in individuals with SSS (Table 1). The epidermal layer of the skin of individuals with SSS has reduced barrier integrity due to differences in lipid composition with a decrease in ceramide and sphingolipid content [8]. This results in increasing the potential penetration of irritants and insufficient protection of nerve endings [5,8–10]. Increased vascular reactivity has been observed in individuals with SSS, resulting in more intense vascular reactions to irritants [11]. Roussaki–Schulze and colleagues reported that vascular reactions to methyl nicotinate in SSS subjects was 75 times higher compared to non-sensitive controls [12].

Table 1. Some Physiological Elements Contributing to SSS.

Epidermal	
[5,8–10]	Reduced barrier integrity
	Decrease in ceramide and sphingolipid
	Increased penetration of potential irritants
	Decreased protection of nerve endings
Vascular	
[12,13]	Increase in vascular activity
	Intense vascular reaction to to methyl nicotinate
	Greater reactions to standard allergens
	Lower alkali resistance
Neurosensorial	
[11,14–16]	Decrease of intraepidermal nerve fiber density
	Reduced peptidergic C-fiber density
	Increase in Transient Receptor Potential Vanilloid-1 (TRPV1)

Neurosensory dysfunction is another physiological element that contributes to SSS. Biopsies from SSS subjects demonstrated a decrease of peptidergic C-fiber density [14]. These fibers are involved in pain, itching and temperature perception. Degeneration of these fibers can induce hyper-reactivity of the remaining nerve endings and a result in allodynia [11]. An additional neurosensory component is an increase in Transient Receptor Potential Vanilloid-1 (TRPV1). This is a non-selective cation channel that responds to heat and low pH, and is related to nociception, neurogenic inflammation, and pruritus. TRPV-1 is also classically known as the capsaicin receptor [15,16]. Based on self-reported SSS skin biopsies, Ehnis–Pérez et al. found TRPV1 is dramatically upregulated in sensitive skin subjects [15].

Another important factor for SSS people is that they may also suffer from skin comorbidities and additional skin disorders (Table 2). Just like SSS, rosacea is more common in individuals who are female with fair skin and hair, blue eyes, and lighter skin, i.e., phototypes I–III [17]. In a genome-wide association study (GWAS) involving 22,952 subjects, Chang and colleagues determined that rosacea is associated with several HLA alleles [18]. This is in line with the inflammatory nature of the syndrome. In a study involving 1000 individuals in Korea, 56.8% of whom had sensitive or very sensitive skin, Kim and colleagues found that the SSS group was over 3 times more likely to suffer from acne, atopic dermatitis, and facial blushing, and over 2 times more likely to suffer from seborrheic dermatitis compared to the non-sensitive group [19]. Brenaut and colleagues found a similar result in an Indian population [20]. In a study involving over 3000 individuals, SSS subjects were 2–4 times more likely to report atopic dermatitis, acne, psoriasis, vitiligo, rosacea, or contact dermatitis compared to the non-sensitive group [20].

Table 2. Some Skin Co-morbidities Associated with SSS.

Skin Condition
Rosacea [17,20,21]
Acne [19,20]
Atopic dermatitis (eczema) [5,19,20]
Atopic [22–24]
Blushing [19]
Seborrheic dermatitis (dandruff) [19,20,25]
Psoriasis [20]
Vitiligo [20]
Contact dermatitis [25]
Freckles [25]
Sensitivity of the corneas and eyelids [26]
Irritable bowel syndrome [26]

Sensitive skin has also been linked to sensitive eyes and eyelids, and irritable bowel syndrome [26,27]. It is proposed that these conditions may be related to the neurosensory dysfunctions identified in SSS, i.e., hyperexcitability of nerve endings, hyperactivation of sensor proteins resulting from upregulation of TRP channels, and alterations in nerve fiber density [26]. The histological findings and clinical signs of small fiber impairment with SSS are similar to those experienced in small-fiber neuropathy [28].

As part of a GWAS, Farage et al. evaluated 23,426 subjects' responses and found that SSS individuals reported other skin complaints, specifically, contact dermatitis, freckles, atopic dermatitis, acne, and seborrheic dermatitis [25]. These authors found an association between SSS and several specific loci also associated with genes for rosacea, pigmentation, and skin cancer [25].

Other Host Related Factors

Aging can be another physiologic factor in sensitive skin. As an individual ages, the skin changes as it becomes thinner and drier, as well as replacing itself at a slower rate [29]. The elderly skin is also more prone to higher permeability but a reduced elasticity, tensile strength, vascularization and cellularity [29]. These physiological changes might lead one to conclude that older skin is more susceptible to irritant effects, and more likely to be sensitive. However, clinical assessments using known irritant materials suggest that skin irritation susceptibility generally decreases with age, as does the capacity to produce visible physiological signs of dermatological irritation [9,29–32]. Several studies have shown that the prevalence of SSS in older individuals is no different or lower than in younger individuals [19,23,33,34]. A 2010 study with 1039 individuals evaluated SSS at several body sites in the US [29]. No consistent pattern with age was seen when subjects were asked about sensitive skin in general, of the face or body, specifically. However, genital area skin sensitivity demonstrated an increase from 53% in subjects $\leq$ 30 years old to 66% in subjects $\geq$ 50 years old (Figure 1). This difference was mainly due to the females in the study.

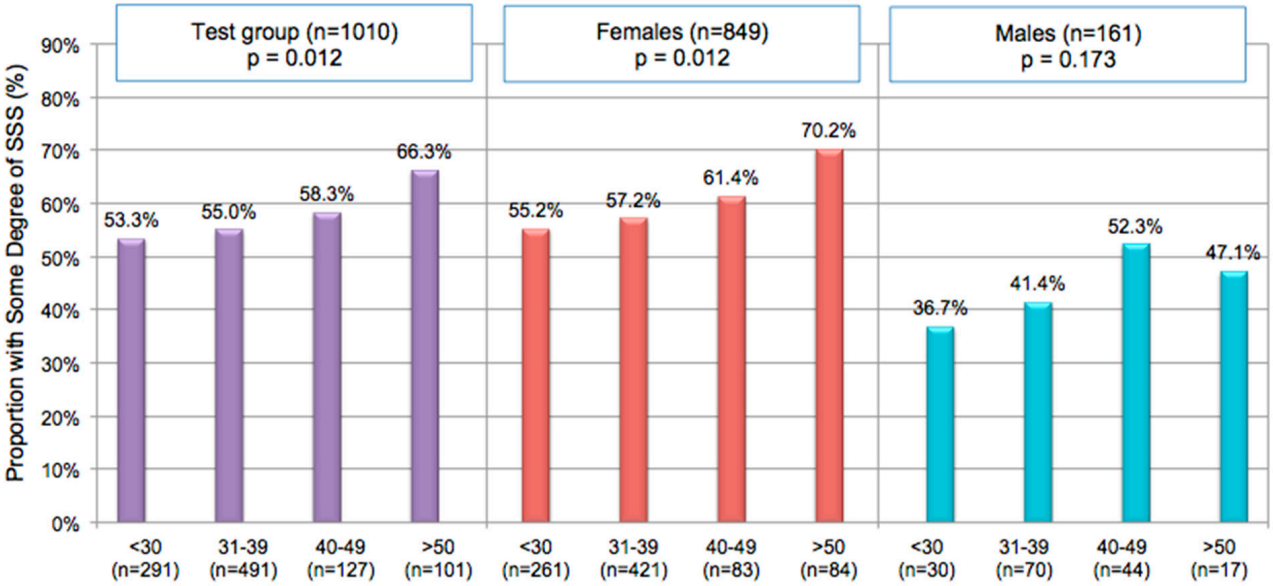

Figure 1. Age and Gender Effect on Prevalence of Sensitive Genital Skin. Responders were asked if they had sensitive skin ("slight", "moderate" or "very") [35,36]. MH Chi-Square was used to test for correlations between perceptions of sensitive skin and age for responders overall and for each gender. Adapted from [37].

Another critical factor is the impact of hormonal fluctuations during the different consumer life stages on skin sensitivity. In both the dermis and epidermis, the skin has highly sensitive estrogen receptors, and variation of female hormones can have an impact on the skin [38]. Decreased estrogen levels can adversely affect barrier function, elasticity, blood circulation and vasomotor function. Farage's study which included 1039 individuals demonstrated that the menstrual cycle was contributing to unpleasant genital skin in 61% of women with SSS and 40% of the non-sensitive skin women ($p < 0.00001$) [37]. Falcone and colleagues reported that women with more intense perimenstrual symptoms perceived their skin as more sensitive during some phases of the menstrual cycle compared to women with lower intensity symptoms ($p = 0.002$) [39]. Furthermore, 70% of postmenopausal women claiming SSS perceived their skin sensitivity increasing after menopause [39]. In general, among SSS women, products used for menstrual protection and hygiene have been shown to trigger significantly greater symptoms than non-sensitive women [37].

3. Psychological Effects of Skin Diseases

As mentioned earlier, individuals with SSS are more likely to also suffer from other skin disorders and co=morbidities. While most skin diseases are not associated with substantial functional impairment, they can have significant adverse effects on the psychological health of sufferers and the overall quality of life (QoL) [40]. Further, the presence of certain other psychological conditions, such as depression, anxiety, stress, and sleep disorders can lead to increased dermatologic symptoms [40]. Hong and colleagues proposed that the psychosocial and occupational impact of cutaneous illnesses can be comparable to other chronic medical conditions [41].

Yew and colleagues conducted an evaluation of an adult population in Singapore [42]. These investigators found that individuals who had a history of skin diseases scored significantly higher on the indices of depression (1.3 in patients vs. 0.6 in controls, $p < 0.001$), and loneliness (3.5 vs. 3.3, $p = 0.002$). In addition, the skin disease group scored significantly lower on the social network index (15.9 vs. 16.6, $p = 0.043$), and the health-related quality of life index (0.89 vs. 0.95, $p < 0.001$). Demographic measures revealed that participants with skin diseases were less likely to be employed, and more likely to have financial constraints and alcohol misuse when compared to their healthy counterparts [42]. Individuals with skin

disease reported higher prevalence of chronic conditions such as diabetes, hypertension, pulmonary disease and arthritis [42]. Dalgard and colleagues conducted a study among 4994 participants (3635 patients and 1359 controls) to evaluate the psychological impact of dermatologic diseases [43]. Using the Hospital Anxiety and Depression (HAD) scale these investigators reported that, compared to control subjects, dermatologic patients had a higher incidence of depression (10.1% in patients vs. 4.3% in controls), anxiety (17.2% vs. 11.1%), and suicidal ideation (12.7% vs. 8.3%). Costeris and colleagues investigated the influence of dermatological disorders on self-esteem and perceived social support in three groups of subjects: patients with severe visible facial acne, patients with non-visible psoriasis/eczema, and control groups composed of participants without dermatologic disorder [44]. Both patient groups showed lower self-esteem and lower perceived social support compared to the control group.

Misery and colleagues evaluated approximately 2000 subjects (1003 women and 935 men) using Short-Form 12 (SF-12) to evaluate the overall QoL [45]. Calculations were made for a Physical Component Summary (PCS-12) and a Mental Component Summary (MCS-12). These investigators found that the MCS-12 score was impaired in individuals with SSS, and the impairment increased in parallel with the severity of the SSS. In a later study these authors showed a similar result with a larger sample of 5000 individuals (2557 women and 2443 men) [23].

In 2018, Misery and colleagues developed a 14-item instrument, the Burden of Sensitive Skin (BoSS) questionnaire, designed specifically to determine the impact of SSS on QoL [7,46]. The BoSS questionnaire is composed of items grouped into three dimensions: Self-Care, Daily Life, and Appearance. The BoSS mean total score for subjects without sensitive skin was 14.05. For subjects with sensitive facial skin the BoSS score was significantly worse at 25.61 ($p < 0.001$). Further, the sensitive subjects had worse scores for each of the 3 BoSS dimensions: Self-Care (14.93 for sensitive subjects vs. 8.20 for non-sensitive), Daily Life (4.64 vs. 2.10), and Appearance (6.03 vs. 3.76), all $p < 0.001$ (Figure 2) [46].

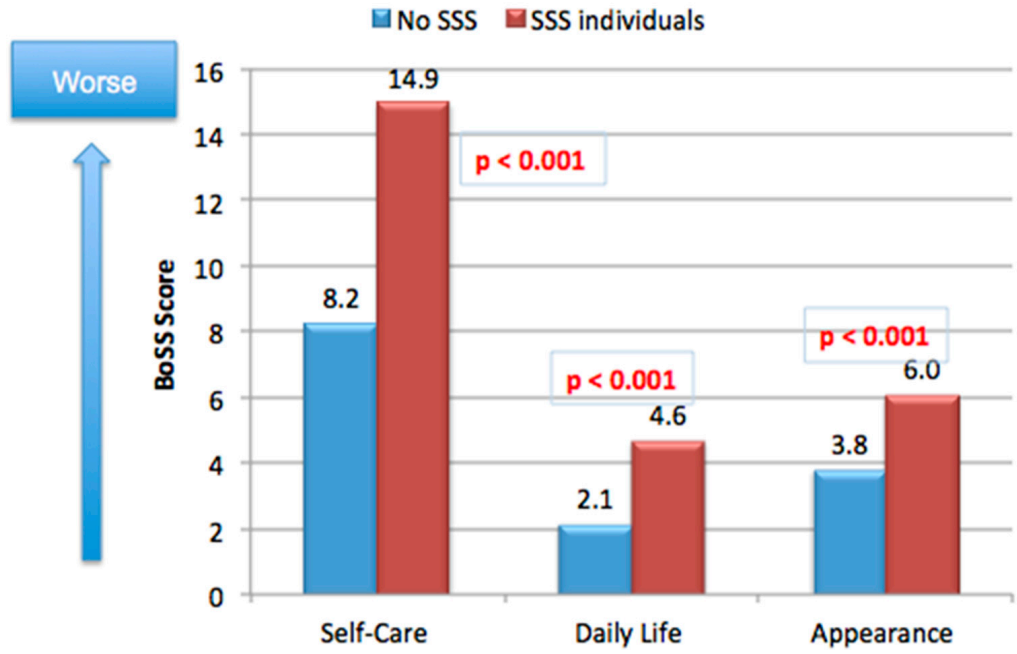

Figure 2. Burden of Sensitive Skin (BoSS). Authors used the 14-item BoSS instrument to evaluate the impact of SSS on the quality of life [7,46]. The instrument evaluated three dimensions (Self-Care, Daily Life, and Appearance). Subjects included 100 women, 59 with self-declared sensitive skin and 41 without sensitive skin. Adapted from [46].

4. Impact of SSS on The Daily Life of Consumers

4.1. Consumers' Behavior: Avoidance and Shopping Practices

Individuals with SSS have identified a wide variety of environmental factors that can trigger their symptoms (reviewed in [1]). These include extremes of humidity (dry or wet weather), extremes of temperature (cold or hot), wind, sun, air conditioning, dust and pollution (Table 3). Lifestyle and personal habits can also trigger symptoms, such as wearing rough fabrics, the use of cosmetics, and exposure to tobacco smoke. A wide array of triggering conditions must be avoided in order to circumvent the onset of SSS symptoms. Such avoidance may lead to a restriction of outdoor or indoor activities important for social interactions, leisure, recreation and fitness [35].

Table 3. Reported Environmental and Lifestyle Triggers of SSS.

	SSS Subjects		Non-Sensitive Subjects		*p* Value	Ref
	Total Responding	Factor Causes Irritation (%)	Total Responding	Factor Causes Irritation (%)		
Environmental						
Humid Weather [a]	641	48%	295	13%	<0.0005	[47]
Dry weather [a]	664	78%	297	54%	<0.0005	
Hot weather [a]	659	66%	295	32%	<0.0005	
Cold weather [a]	675	87%	303	70%	<0.0005	
Sun [a]	673	82%	306	66%	<0.0005	
Wind [a]	654	71%	292	53%	<0.0005	
Air conditioning [b]	63	13%	22	5%	<0.001	[33]
Temperature variation [b]	210	47%	104	19%	<0.001	
Water [b]	69	15%	33	6%	<0.001	
Pollution [b]	3249	63%	1823	33%	<0.001	[48]
Dust [b]	2990	58%	1633	29%	<0.001	
Lifestyle and habits						
Rough fabrics [a]	666	71%	293	43%	<0.0005	[47]
Cosmetics [b]	2989	58%	1250	22%	<0.001	[48]
Sweating [b]	2814	54%	1496	27%	<0.001	
Tobacco smoke [b]	2055	40%	1135	20%	<0.001	
Food [b]	2262	44%	950	17%	<0.001	

Potential triggers of SSS symptoms were included from multiple sources, as indicated. Statistical analyses compared subjects with SSS to individuals with non-sensitive skin by methods described in the appropriate references. [a] SSS subjects include individuals with any degree of sensitivity (very, moderate, slight). [b] SSS subjects include only individuals with very or moderate sensitivity.

Factors that contribute to the symptoms of SSS may differ depending on age group. Among those who claimed to have sensitive skin, hot weather and rough fabrics were the factors most strongly associated with skin sensitivity among the oldest adults (aged 50 and above) and were specifically associated with genital skin sensitivity in this group (Table 4) [1]. Cold weather was most strongly associated with skin sensitivity in midlife (40–49 age group); and stress was the most important factor cited by younger adults (i.e., individuals under 40) [1]. The menstrual cycle was perceived to contribute to skin sensitivity by women of all age groups except those aged $\geq$50.

A large number of everyday products were identified by SSS individuals as potential triggers to SSS symptoms. These include facial products and cosmetics, personal care products, and common household products (Figure 3). A Cincinnati study reported by Farage with 1039 individuals reported that 68.4% of the study population claimed their skin was sensitive to some degree (very, moderately, or slightly) [49]. SSS seems to also influence shopping behavior and practices. Subjects claiming SSS were 5 times more likely to look for skin related claims on products (such as, "safe for sensitive skin" and "hypoallergenic")

compared to non-sensitive subjects (OR = 5.3) (Figure 4a), and 5 times more likely to avoid specific ingredients because the individual perceived they caused skin irritation (OR = 5.2) (Figure 4b).

Table 4. Perceptions about irritation due to environmental factors for those claiming genital skin sensitivity.

Sensitive Skin in the Genital Area	Hot Weather		Cold Weather		Rough Fabric		Dry Weather		Stress		Humid Weather		Menstrual Cycle [a]	
≥50 years old														
Total sensitive responders	59		59		64		60		62		60		23	
Factor causes irritation (%)		88% [b]		86%		86% [c]		72%		58%		47%		30% [d]
40–49 years old														
Total sensitive responders	68		70		70		67		68		66		42	
Factor causes irritation (%)		57%		79%		71%		73%		44% [e]		39%		52%
31–39 years old														
Total sensitive responders	256		261		255		257		256		245		229	
Factor causes irritation (%)		64%		86%		71%		79%		62%		44%		62%
≤30 years old														
Total sensitive responders	151		151		150		152		150		147		137	
Factor causes irritation (%)		59%		82%		75%		76%		65%		45%		65%

A total of 1039 individuals participated in the study on self-reported sensitive skin [47]. Total sensitive responders refer to the number of subjects with skin sensitivity of the genital area who responded to this question. The percentage of these responders who claimed the environmental factor caused some degree of skin irritation (i.e., "sometimes", "frequently", or "always") is given in the following line. Paired comparisons of age groups were done using the MH Chi-Square test. Adapted from [1,29]. [a] Women only. [b] Age group ≥ 50 was significantly higher than 40–49, 31–39 and ≤30 age groups ($p \leq 0.001$). [c] Age group ≥ 50 was significantly higher than 40–49, 31–39 and ≤30 age groups ($p \leq 0.03$). [d] Age group ≥ 50 was significantly lower than 31–39 and ≤30 age groups ($p < 0.02$). [e] Age group 40–49 was significantly lower than 31–39 and ≤30 age groups ($p < 0.02$).

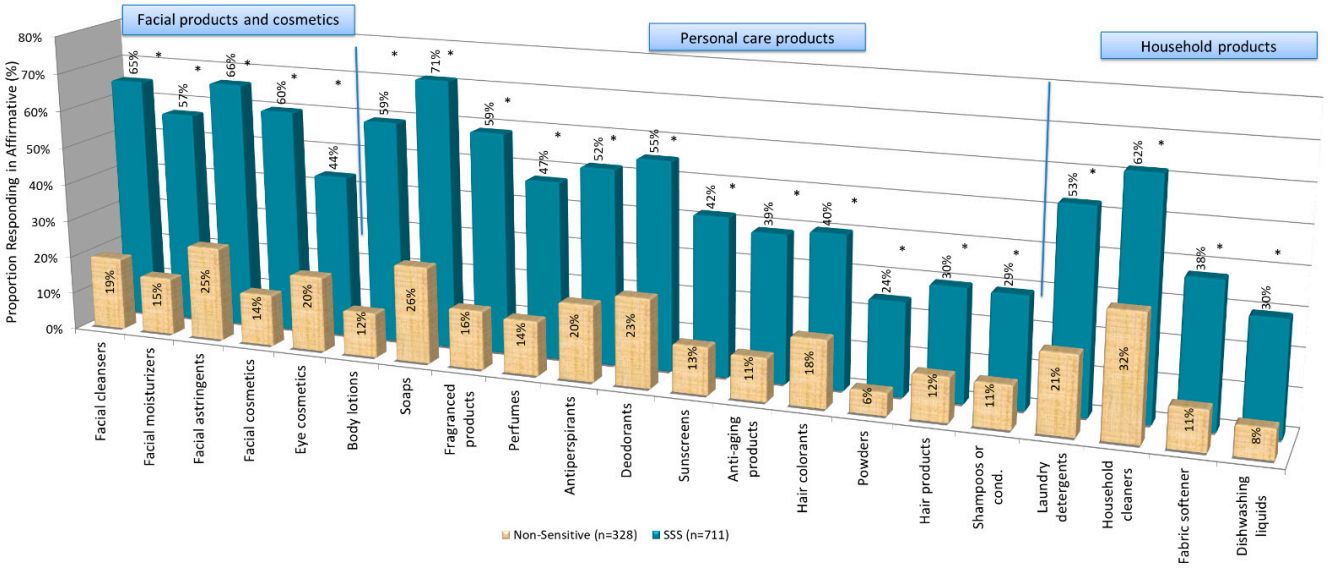

Figure 3. Product Categories Reported to Trigger SSS Symptoms. Responders in the Cincinnati study were asked if a variety of categories of cosmetics, personal care and household products had ever caused adverse reactions to their skin [35,36]. For all product categories the proportion of SSS individuals who responded positively was significantly higher than the number of non-SSS individuals who responded positively. (* = $p < 0.00001$).

Consumer product manufacturers are now fully aware of the need to develop products specifically for individuals with SSS. Our laboratory developed and validated a self-administered scientific tool, (the Farage Quality of Life [FQoL^{TM}]), to assess the potential impact of a variety of consumer products on Health Related QoL (HRQoL) [50,51]. The tool consists of 27 general items scored on a Likert scale and covering Overall Quality of Life (1 item), Well-Being (12 items), and Energy and Vitality (14 items). The Well-Being

domain has 3 subscales: Emotion, Self-Image, and Self-Competence; the Energy and Vitality domain also has 3 subscales: Personal Pleasure, Physical State, and Routine Activity. The resulting FQoL^{TM} instrument has been used several times to evaluate the impact of various consumer products on the consumers' quality of life [52].

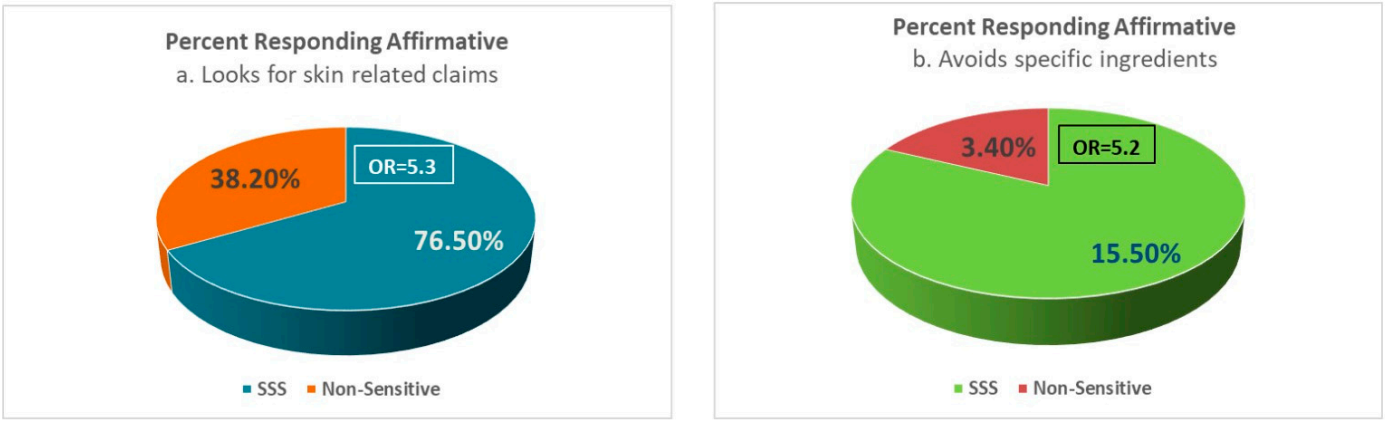

Figure 4. SSS Consumers and Shopping Practices. In the Cincinnati study, responders were asked about specific shopping practices. Compared to the non-SS group, the SS subjects were far more likely to: (**a**) look for skin related claims on products (such as, "safe for sensitive skin" and "hypoallergenic") (OR = 5.3), and (**b**) avoid specific ingredients when shopping (OR = 5.2).

4.2. Fatigue and Sleep Disorders

Fatigue has a high prevalence among patients with skin diseases [53]. In a study conducted in France by Misery and colleagues among 2502 individuals, these authors found the risk of fatigue was over four times greater for individuals with skin diseases compared to those with no skin diseases [54]. Sleep disorders and fatigue are common in patients with inflammatory skin disorders, such as psoriasis and chronic eczema [55], and have been reported as upstream drivers of other sensory disorders [48].

Itch and pain are major symptoms of sensitive skin and can contribute to sleep disorders [11]. In a 2019 publication, Schmelz reported that individuals classified as having sensitive skin experienced itching and pain sensations upon weak external stimuli that are not typically painful or itchy in individuals without sensitive skin [56]. Halioua and colleagues found that subjects suffering from cutaneous disorders had a significantly higher severity of sleep disorders compared to control subjects without cutaneous disorders (4.1 $\pm$ 2.51 versus 3.5 $\pm$ 2.3, respectively, p = 0.0019) [57]. These authors found that pain and pruritus were good predictors of sleep disturbance with odds ratios of 1.7 [95% CI 1.4–2.0] ($p < 0.0001$), and 1.6 [95% CI 1.3–2.0] ($p < 0.0001$), respectively.

Misery and colleagues conducted a survey among 5 different countries [48]. Participants were asked to rate the severity of sleep disorders and unpleasant skin sensations on numerical scales with 0 being no disturbance and 10 being the maximum. A score of <3 was considered mild, between 3 to $\leq$7 was considered moderate, and $\geq$7 was considered severe. Among the 10,743 participants 8296 subjects reported sleep disorders. Approximately half of these (4295 or 51.77%) also reported SSS. Subjects with SSS had significantly worse (higher) scores for sleep disorders (3.6 out of 10) compared to subjects without sensitive skin (1.6 out of 10) ($p < 0.001$) [48]. Xiao and colleagues found similar results in a China study which included 22,085 women [34]. These authors reported that SSS was more likely in individuals who slept 6 h compared to 8 h (OR 1.36, p = 0.001), and in individuals retiring at or later than 2 a.m. compared to 10 p.m. (OR 1.81, p = 0.007).

4.3. Stress, Anxiety and Depression

Depression, anxiety and emotional distress can have a deleterious effect on many conditions including dermatological diseases and may initiate the itch-scratch cycle [58].

Stressors such as helplessness and worrying may have a role in worsening the itch sensation of patients with skin diseases [59]. Dalgard and colleagues reported a study conducted with 3635 dermatology out- patients with common skin diseases and 1359 controls [43]. Subjects were administered the Hospital Anxiety and Depression Scale (HADS) questionnaire. Among the patient group, 35.6% reported stress compared with 30.6% of the controls ($p < 0.001$). In addition, the patient groups demonstrated a significantly higher prevalence of clinical depression (10.1% in patient group vs. 4.3% in the control group, $p < 0.001$), anxiety (17.2% vs. 11.1%, $p < 0.001$), and suicidal ideation (12.7% vs. 8.3%) [43].

Stress has been known to trigger dermatological conditions such as psoriasis, rosacea and atopic dermatitis [60–62]. In the study conducted by Farage, stress was identified as a contributing factor to skin irritation by 51% of the total subjects responders (485 out of 954) [47]. Stress was perceived as a contributor by 63% (415 out of 654) of SSS subjects, compared to 24% (70 out of 290) of the subjects without SSS ($p < 0.0005$) [1,47]. Saint–Martory and colleagues reported a similar result among 400 women in France, where about 61% of the participants who perceived sensitive skin of the face identified stress as a contributing factor [63].

In a study conducted by Misery and colleagues among 1000 subjects in the USA, skin reactivity to emotion was significantly higher among individuals who identified as having "sensitive" or "very sensitive" skin compared to individuals who identified as "slightly" or non-sensitive skin. (53% vs. 47%; $p < 0.001$) [33].

SSS individuals are more likely to feel stress. Misery and colleagues evaluated Quality of Life (QoL) using the SF-12 questionnaire [45]. Individuals with sensitive or very sensitive skin had a worse QoL than individuals without. In addition, the QoL deteriorated as the severity of sensitive skin increased. More recent studies have also shown similar results [23,64]. Stress was reported as a trigger of unpleasant skin symptoms by 63% of the SSS subjects in a study involving 1039 subjects [47]. In that same study responders in different age groups were asked if they had some degree of genital sensitivity, and whether or not specific environmental factors triggered the unpleasant sensations of SSS in the genital area [29]. Overall, 58% of individuals with irritation in the genital area claimed stress was a trigger. Xiao and colleagues reported that the likelihood of SSS increased with the amount of stress in the lifestyle [34]. Compared to individuals with no stress in their lives, SSS was more likely in individuals who experienced mild stress (OR 1.31, $p = 0.001$), or heavy stress (OR 1.57, $p = 0.001$).

4.4. The Stress of COVID Containment

Kluger and colleagues evaluated the potential effects of containment during the 2020–2021 COVID-19 pandemic and its effects on skin condition among subjects in 5 countries (Brazil, China, France, Russia and the USA) [65]. The study included 7170 individuals who reported they complied with containment procedures. Among those, 20.9% (1500 out of 7170) responded that their skin condition had worsened due to containment. The three main reported changes were drier skin (44.5%), skin rash (29.3%), and greasier skin (27%). The investigators suggested that mask wearing and stress may have contributed to skin condition changes. Subjects were then divided into a SSS group including 3410 individuals (47.6%) who reported they had sensitive or very sensitive facial skin, and a non-sensitive group including 3760 individuals (52.4%) who had skin that was not very sensitive or not at all sensitive. Individuals in the SSS group were more likely to report skin changes during containment compared to the non-sensitive group (27.7% vs. 14.8%, respectively, $p < 0.00001$).

As mentioned previously, our laboratory developed and validated an instrument to assess the potential impact of various consumer products on QoL (i.e., the FQoL) [50,51]. We were conducting a study among 63 healthy women aged 23–54 years old for a consumer product using the FQoL^{TM} when the COVID-19 pandemic hit. We took advantage of this study to gain insights on the impact of COVID-19 on the different FQoL^{TM} domains and sub-domains. Responses to the instrument had been collected on 19 February 2020 which

was prior to the 15 March 2020 pandemic stay-at-home orders (i.e., Pre-COVID). A second set of responses were collected in the early days of the stay-at-home mandate (i.e., Early COVID), and a third set after 24 days of at-home confinement (i.e., Day 24 of COVID-19 on 7 April 2020). Results of the domain analyses in the previously unpublished study are presented in Figure 5. We observed a significant decline in overall quality of life, and in the Well-Being domain and the Energy and Vitality domain.

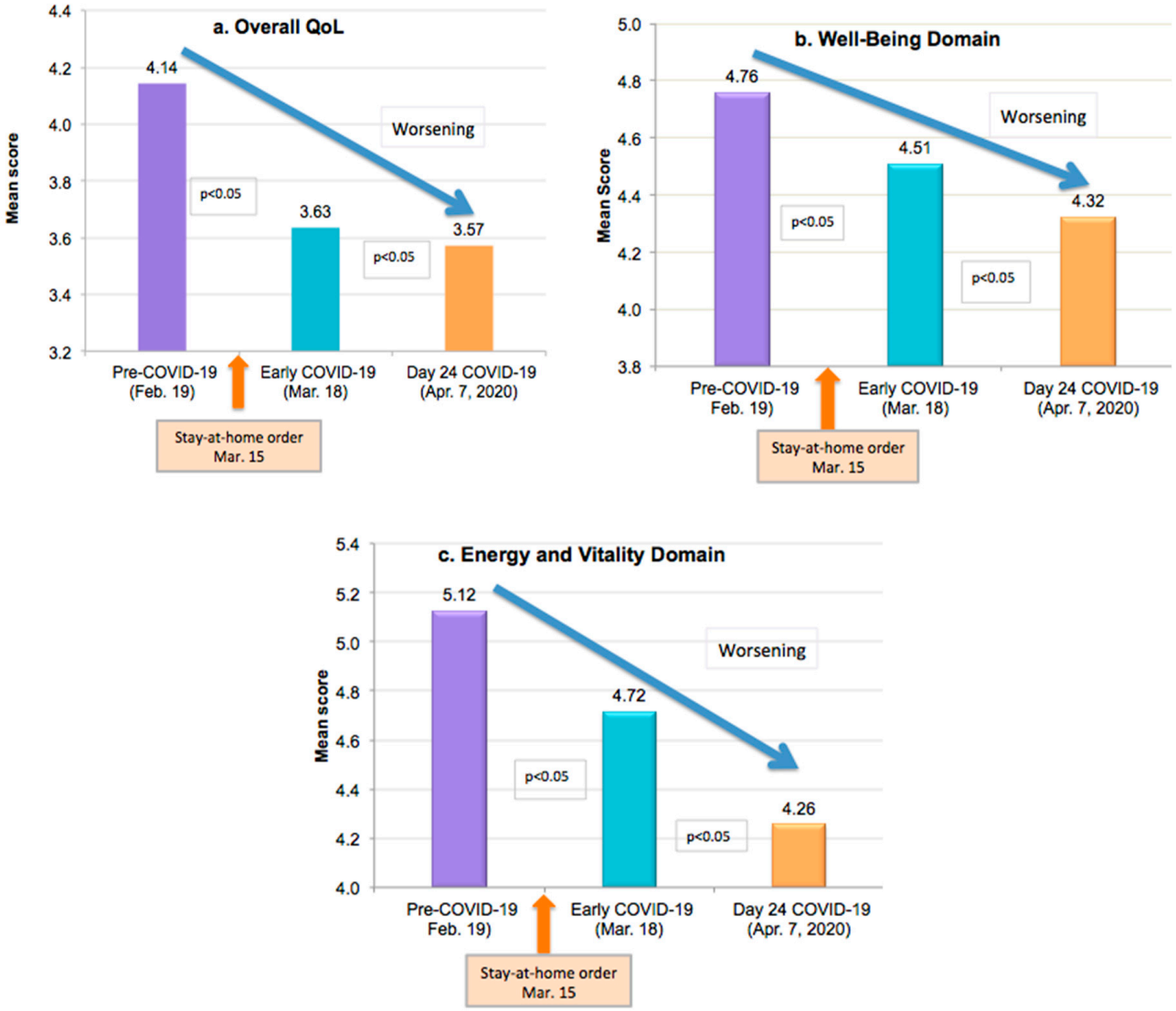

Figure 5. Effect of COVID-19 Confinement on QoL. The study was conducted among 63 healthy women aged 23–54 years old. Responses to the FQoL^{TM} were collected prior to the 2020 pandemic stay-at-home orders (19 February), 3 days after the 15 March stay-at-home orders (18 March), and 24 days after the stay-at-home orders (7 April). Mean scores for the overall QoL (**a**), the Well-Being Domain (**b**), and the Energy and Vitality Domain (**c**) are presented. The subdomains and domains were averages of responses to individual items within that grouping, and means were. evaluated using a paired *t*-test. The 2-sided *p* values are reported. All analyses were done using JMP Pro version 14.2.0 and SAS 9.4 (Baiyang Wang-Statistician).

When subdomains were further evaluated (Table 5), everyone exhibited a significant worsening of scores. One very interesting finding was within the Personal Pleasure subdomain. This subdomain includes questions about things individuals do for leisure and recreation. A large percentage of respondents (71.4%) checked the "not applicable" option, which is a true reflection of an absence of activities during the stay-at-home orders.

Table 5. Quality of Life Pre- and Post-COVID Stay-At-Home Orders.

FQoL™	Evaluation Timepoint in 2020 (Mean Scores)					
Domains and Subdomains	**Pre-COVID-19 (19 February)**		**Early COVID-19 (18 March)**		**Day 24 COVID-19 (7 April)**	
Overall QoL	**4.14**	*	**3.63**	*	**3.57**	*
Well-Being Domain	**4.76**	*	**4.51**	*	**4.32**	*
Emotion subdomain	4.88	*	4.44	*	4.35	*
Self-Image subdomain	4.37	*	4.32	*	4.05	*
Self-Competence subdomain	5.44	*	5.14	*	4.93	*
Energy and Vitality domain	**5.12**	*	**4.72**	*	**4.26**	*
Personal Pleasure subdomain	5.27	*	4.76	*	4.22	*
Physical State subdomain	4.53	*	4.38	*	4.18	*
Routine Activity subdomain	5.71	*	5.16	*	4.51	*

* Significant, $p < 0.05$.

5. Conclusions

Many dermatological diseases are associated with problems such as depression, anxiety, stress, and sleep disorders. The same can be said for SSS. Although SSS does not present with objectively treatable signs and symptoms, individuals with SSS can suffer from the same psychological problems. In addition, individuals with SSS are more likely to suffer from co-morbidities and other skin disorders such as acne, atopic dermatitis, psoriasis, rosacea, vitiligo, or contact dermatitis. This can lead to feelings of helplessness and worry that can further exacerbate symptoms of SSS such as itch and irritation and can result in sleep disorders, fatigue, stress and anxiety. Conversely, lack of sleep and stress from these sources can make the SSS sufferer more prone to the symptoms. This becomes a vicious cycle that impacts consumers' quality of life and well-being.

Individuals with SSS have identified a wide array of external factors that can trigger their symptoms, including weather and environmental conditions, and exposure to a multitude of household and personal products. Attempts to avoid such factors in order to circumvent the onset of SSS symptoms can result in restriction of outdoor or indoor activities important for social interactions, leisure, recreation and fitness. Questionnaire-based Quality of Life type instruments have demonstrated that sensitive skin subjects score worse in satisfaction with appearance, daily life and a sense of well-being. Subjects with SSS had significantly worse scores for sleep disorders compared to subjects without sensitive skin.

Becoming aware of the vicious psychological cycle that can impact SSS individual can help both the practitioner and consumer to understand, manage and develop more appropriate approaches and programs (i.e., treatments; therapies, etc.) to drive a more holistic well- being impact for SSS consumers.

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