Male versus female skin: What dermatologists and cosmeticians should know

S. Rahrovan, MD, MPH a, F. Fanian, MD, PhD b, P. Mehryan, MD a, P. Humbert, MD, PhD b, A. Firooz, MD a,⁎

a Center for Research and Training in Skin Disease and Leprosy, Tehran University of Medical Sciences, Tehran, Iran
b Research and Studies Center on the Integument, Department of Dermatology, Clinical Investigation Center, Besançon University Hospital, University of Franche-Comté, Besançon, France

Abstract

Introduction: The skin is important for the perception of health and beauty. Knowledge of the physiological, chemical, and biophysical differences between the skin of male and female patients helps dermatologists develop a proper approach not only for the management of skin diseases but also to properly take care of cosmetic issues. The influence of genetic and environmental factors on skin characteristics is also critical to consider.

Methods: A literature search of PubMed and Google was conducted to compare the biophysical and biomechanical properties of the skin of male and female patients using the keywords “skin”, “hydration”, “water loss”, “sebum”, “circulation”, “color”, “thickness”, “elasticity”, “pH”, “friction”, “wrinkle”, “sex”, “male”, and “female”.

Results: A total of 1070 titles were found. After removing duplications and non-English papers, the number was reduced to 632. Of the 632 titles, 57 were deemed suitable for inclusion in this review. The studies show that the skin parameters of hydration, transepidermal water loss, sebum, microcirculation, pigmentation, and thickness are generally higher in men but skin pH is higher in women.

Conclusions: These parameters can be considered as age markers in some cases and are susceptible to change according to environment and lifestyle. Biometrological studies of the skin provide useful information in the selection of active principles and other ingredients of formulations to develop a specific approach for cosmetic treatments.

Introduction

The skin is the largest multifunctional organ in the body. It functions as a protective physical barrier by absorbing ultraviolet radiation and preventing microorganism invasion and chemical penetration. The skin also controls the passage of water and electrolytes and has a major role in the thermoregulation of the body, in addition to its immunological, sensory, and autonomic function. Understanding the physiological, chemical, and biophysical characteristics of the skin helps us develop a proper approach for the management of skin diseases. However, the influence of genetic and environmental factors on the skin is also critical to consider.

Researchers have assessed skin parameters in different parts of the body in men and women separately. The knowledge of sex-linked cutaneous differences might help in study planning and the development of female- versus male-specific products for more appropriate dermatological treatments or cosmetic interventions.

There are sex-related differences in anatomy, physiology, epidemiology, and the manifestations of several diseases. With regard to skin disorders, infectious diseases are presented more in men but psychosomatic problems, pigmentary disorders, certain hair diseases, and autoimmune and allergic diseases are more common in women. Indeed, there are more sex-associated dermatoses in women and the occurrence and prognosis of certain skin malignancies are related to sex-related differences (Chen et al., 2010).

The mechanisms that underlie sex-related differences in skin diseases are mostly unknown. Sex hormones, behavioral factors, ethnicity, and differences in environment may all contribute to these differences. A better understanding of sex-related differences in human health and diseases will help better prevent, diagnose, and treat skin diseases (Chen et al., 2010).

A literature search of PubMed and Google was conducted through February 2017 using keywords including “skin”, “hydration”, “water loss”, “sebum”, “circulation”, “color”, “thickness”, “elasticity”, “pH”,...
“friction”, "wrinkle”, "sex”, “male”, and “female”. Only articles of high quality that directly pertained to the biophysical and biomechanical properties of the skin in men and women were included.

A total of 1070 titles were found. After the removal of duplications and non-English papers, this number was reduced to 632 titles, of which 57 were deemed suitable for inclusion in this review by 2 of the authors (A.F. and P.H.).

Hydration

Stratum corneum (SC) hydration has an important role in skin function, such as the regulation of epidermal proliferation, differentiation, and inflammation. Table 1 provides the findings of studies that compared skin hydration between male and female skin.

Mac-Mary et al. (2006) showed that natural mineral water supplementation may be used to improve the hydration of skin dryness as a complementary cosmetic approach. Liu et al. (2012) found that sun-induced changes of SC hydration vary with age and sex in a normal Chinese population. Sun-exposure effect in SC hydration was not significant in young men and women but was significant in aged women. The reduction of SC hydration was significant on the forehead and dorsal hand of sun-exposed subjects. Sun-induced reduction of SC hydration was more obvious on the dorsal hand of aged women than that of men (p < .001). Furthermore, the SC rehydration capacity in sun-exposed aged female subjects was significantly lower than that of age-matched male subjects.

A German study conducted by Luebberding et al. (2013) demonstrated that young men showed higher levels of SC hydration in comparison with women. However, SC hydration was stable or even increased in women during their lifetime but decreased over time in men beginning at age 40 years. In a study by Man et al. (2009), SC hydration on the forehead in both men and women age >70 years was lower than that in younger age groups. SC hydration on the forehead in both men and women was not significantly different from that on the forearm. A comparison of age-matched men and women by Rogiers et al. (1990) demonstrated no sex-related differences in SC hydration.

Li et al. (2014) enrolled 86 patients in Chengdu, China in a single-center, non-interventional study. Candidates had two study visits (summer of 2010 and winter of 2011) at which dermatologists measured transepidermal water loss (TEWL), skin hydration, sebum secretion, fine lines/roughness, melanin/erythema, temperature, and color and clinically graded participants' skin. They found that the skin of female participants was significantly more hydrated than that of male participants.

Transepidermal water loss

TEWL is used to assess skin water barrier function. Jacoby et al. (2005) and Wilhelm et al. (1991) reported equal TEWL in both sexes in their studies. However, Luebberding et al. (2013) showed that in participants age <50 years, TEWL in men was significantly lower than in women of the same age, regardless of the location. The difference in evaporimetry results between men and women diminished with increased age at all localizations except for the forehead. In participants age 50 to 60 years, TEWL on the forehead, cheeks, and neck in men was higher than in women of the same age. In general and regardless of age, men showed significantly lower TEWL than women. In most sites, water loss was stable or increased over subjects' lifetime in both sexes.

Both Tupker et al. (1989) and Lamminantausta et al. (1987) could not establish a difference in TEWL between men and women under basal conditions. Neither the number of tape stripplings required for perturbing the barrier nor the rates of barrier recovery were significantly different in women compared with men (Reed et al., 1995). A summary of TEWL in male and female skin is presented in Table 2.

Sebum

Table 3 presents the findings of studies that compared skin sebum in male versus female skin. Jacoby et al. (2005) and Wilhelm et al. (1991) reported that sebum production was equal in the skin of men and women. However, Bailey et al. (2012) found higher sebum levels in male subjects in different parts of the face, except for the forehead, where female subjects had higher sebum levels.

Luebberding et al. (2013) demonstrated that sebum content in men was relatively stable on the cheeks and increased slightly on the forehead with age but progressively decreased in women over their lifetime. In a study by Man et al. (2009), sebum content on the forehead was higher in men ages 13 to 70 years than in age-matched women.

Men have been reported to have higher sebum production and larger pore size (Pochi and Strauss, 1974). A Korean study of 30 male and 30 female subjects found a striking positive correlation between male sex, pore size, and sebum excretion (Roh et al., 2006). In a study by Mizukoshi and Akamatsu (2013), sex-related differences and men's subjective perceptions of skin and daily skin care habits were investigated using simple instrumental measurements. The results showed that male skin had two specific characteristics because of the excess amount of sebum: impaired barrier function and a lack of appropriate skin care regimen due to tacky feeling. In a comparison of sebum secretion by sex, the skin of female participants was less oily on the face and neckline (Li et al., 2014).

Skin thickness

Shuster et al. (1975) studied a large number of normal subjects and measured forearm skin collagen, dermal thickness, and collagen density and concluded that the skin collagen decreased with age and was less in female subjects of all ages. They demonstrated that skin thickness in men decreased linearly with age, starting at age 20 years but remained constant in women until the age of approximately 50 years, at which time skin thickness started decreasing. The study concluded that skin thinning with age is the result of collagen loss. In fact, there is a positive correlation between levels of hydroxyl-proline (a major component of the protein collagen) and caliper-measured skin thickness.

According to Leveque et al. (1984), skin thickness starts to decrease at the age of 45 years in both men and women. The decrease of skin thickness and loss of hydroxyl proline have been suggested to be consequences of hormonal imbalances that are associated with menopause. In biopsies from women who were treated for 2 to 10 years with estradiol and testosterone, the hydroxyl-proline level was nearly 50% higher than that of age-matched untreated postmenopausal women (Brincat et al., 1983). The results of a study by Tur (1997) support this suggestion and showed that an ovariectomy is associated with the thinning of the skin but estrogen therapy thickens the skin.

Eisenbeiss et al. (1998) used 20 MHz sonography and showed that there is a positive correlation between the thickness of the skin and the level of sex hormones in fertile women. They suggested that this is the consequence of hormone-induced water retention in the skin. Ya-Xian et al. (1999) found great variations in the number of stratum corneum cell layers by location and among 301 individuals of various ages. Frozen 6-micron-thick sections were stained with a 1% aqueous solution of safranin and observed under a microscope after application of 2% potassium-hydroxide solution. There was no definite correlation between the number of corneocyte layers and
| Reference                  | Number | Age            | Location                                                                 | Measurement Device                                                                 | Male Mean ± SD | Female Mean ± SD | P value         |
|----------------------------|--------|----------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------|-----------------|-----------------|
| Firooz et al. (2012)       | 50     | 10-60 years    | right side of forehead, cheek, nasolabial fold, neck, forearm, dorsal side of the hand, palm and leg | Corneometer (Courage & Khazaka electronic GmbH, Cologne, Germany)                    | 48.42 AU       | 49.06 AU        | non-significant |
| Jacobi et al. (2005)       | 6 women | 24.3 ± 0.8 years | flexor forearm                                                             | Corneometer CM 820 (Courage & Khazaka, Cologne, Germany)                            | 75.3 ± 12.8 AU | 72.7 ± 8.1 AU    | non-significant (p > 0.05) |
| Wilhelm et al. (1991)      | 7 male  | 26.7 ± 2.8 years | forehead, dorsal aspect of the upper arm, dorsal and volar aspects of the forearm, postauricular region, palm, abdomen, upper and lower part of the back, extensor surface of the thigh, and ankle (approximately 4 cm distal to the medial malleolus) | capacitance meter (Corneometer CM 820 PC, Courage & Khazaka, Cologne, Federal Republic of Germany) | not available | not available    | no significant differences |
|                          | 7 female | 70.5 ± 13.8 years |                             |                                                                                      |                |                 |                 |
| Mac-Mary et al. (2006)     | 80     | 56 ± 5.6 years | randomized forearm                                                        | Evaporimeter EP1 (Servomed, Stockholm, Sweden)                                      | 33.33 (6.00) AU | 34.50 (4.96) AU | significant (p = 0.001 for male & p < 0.005 for female) |
| Liu et al. (2012)          | 168    | 19–75 years    | forehead and the dorsal hand                                             | multifunctional skin physiology monitor                                             | not available  | not available    | significantly Lower on dorsal hand of sun-exposed subjects in aged females (p < 0.001) |
| Bailey et al. (2012)       | 88     | 18-61 years    | facial and abdominal skin                                                 | Corneometer CM825 attached to Derma Unit SSC3 (CK Electronic, Koln, Germany)         | Jowl (50.01) AU | Jowl (54.60) AU | significant (p < 0.005) |
|                          |        |                |                                                                          | Abdomen (49.66) AU                                                                 | (Neck) (33.05) AU | (Neck) (59.58) AU | (Abdomen (38.96) AU) |
| Luebberding et al. (2013)  | 300    | 20-74 years    | forehead, cheek, neck, volar forearm and dorsum of hand                  | Corneometer® CM 825 (Courage & Khazaka, Cologne, Germany)                            | 48.76 ± 7.15 (CM Units) |                          | not available |
| Man et al. (2009)          | 713    | 0.5-94 years   | forehead and forearm (flexor site)                                       | Corneometer CM 825 attached to a Courage & Khazaka MPA5 system                     | 43.99 ± 1.88 AU (13–35 years) |                          | significant (p < 0.01) |
| Li et al. (2014)           | 43 men and women and their 43 consanguineous same-sex children | 40–50 years | face, décolletage, back of hand, outer forearm, lower outer leg, and heel | capacitance-based Corneometer® CM 825, by Courage & Khazaka                        | not available  | not available    | Female skin was significantly more hydrated [décolletage in winter, hand in summer and winter], except for the heel that was dryer. |

AU, arbitrary unit; CM, arbitrary unit
sex of the individual, but there was a slight increase in the number of SC layers with age in the skin on the cheek and back, especially in male individuals.

Mogensen et al. (2008) found no sex or skin type-related differences in epidermal thickness using optical coherence tomography imaging, which is based on infrared light reflection/backscatter from tissue. Gambichler et al. (2006) studied 83 subjects using optical coherence tomography imaging in vivo and performing intra- and interday repeatability measurements. The results showed that epidermal thickness did not significantly differ between men and women except for the forehead skin, which was significantly thinner in older women than in men. The comparison of skin thickness between male and female skin is presented in Table 4.

Skin pH

Bailey et al. (2012) reported that skin pH is lower (ie, more acidic) in men, but a study by Zlotogorski (1987) showed that skin pH was not correlated with sex. In the study by Luebberding et al. (2013), skin pH was highest in the cheeks in both sexes. The female forehead and male hand had the lowest pH. Except for a few areas, especially the forehead, the pH value of female subjects was always > 5. With regard to age, an increasing trend in pH value was only seen in men.

Sex and sex hormones are generally accepted to not exert (or have only minor) effects on skin surface pH (Burry et al., 2001; Fluhr et al., 2004; Yosipovitch et al., 1993). Single studies have reported slight sex variances in pH that is attributed to different cosmetic

![Fig. 1. Skin thickness (μm; Bailey et al., 2012)](image-url)

### Table 2

| Reference            | Number | Age          | Location                                | Measurement Device                                                                 | Male     | Female    | P value       |
|----------------------|--------|--------------|-----------------------------------------|------------------------------------------------------------------------------------|----------|-----------|---------------|
| Firooz et al. (2012) | 50     | 10-60 years  | right side of forehead, cheek, nasolabial fold, neck, forearm, dorsal side of the hand, palm and leg | TEWAmeter (Courage & Khazaka electronic GmbH, Cologne, Germany)                   | 15.49 gr/h.m^2 | 9.52 gr/h.m^2 | Significant   |
| Luebberding et al.   | 300    | 20-74 years  | hand, hand, forearm                      | Tewameter® TM 300; Courage & Khazaka                                             | 10.92 ± 3.36 gr/h.m^2 | 5.50 ± 2.02 gr/h.m^2 | Significant (p<0.05) |
| Chilcott and Farrar  | 17     | 18-28 years  | volar forearm                            | ServoMed Exp-2 (ServoMed, Kinna, Sweden)                                         | 4.94 ± 0.31 g/m^2/h | 4.68 ± 0.27 g/m^2/h | p<0.05        |
| Giusti et al. (2001) | 70     | 8 to 24 months| volar forearm, buttock                    | Evaporimeter (EPI; Servomed, Stockholm, Sweden)                              | 8.57 ± 2.52 g/m^2/h | 8.17 ± 2.20 g/m^2/h | No statistically significant differences |
| Fluhr et al. (2001)  | 21     | mean age 50.6 years | mean age 50.6 years                      | noninvasive exfoliation method, videomicroscopy and image analyses (NIH Image 1.59) | not available | not available | No statistically significant differences |
| Li et al. (2014)     | 43     | 18-25 years  | face, décolletage, back of hand, outer forearm, lower outer leg, and heel | Tewameter® (TM 210; Courage & Khazaka, Koln, Germany)                          | not available | not available | Significantly lower in females |
habits (Parra and Paye, 2003). During the postnatal period, a rapid
decline in pH was observed during the first week, and a gradual
decline during the next 3 weeks was measured. In contrast, other
studies could not confirm sex-related differences in infants (Harpin
and Rutter, 1983; Hoeger and Enzmann, 2002). The results of a
study by Wilhelm et al. (1991) demonstrated no difference in pH
values between men and women on most anatomic regions. Studies
that compare skin pH in male versus female skin are presented in
Table 5.

Microcirculation

Hornstra et al. (2014) studied 260 participants (mean age: 42
years; 47% men) and demonstrated that there was a negative, nonlinear
relationship between homocysteine and baseline capillary
density in men. The study also showed a lower capillary density in the
highest tertial of homocysteine (adjusted B: –8.65 capillaries/mm²
95% confidence interval, –16.05 to –1.25; p = .02), but no significant
association was found between homocysteine and microvascular
outcomes in women. In addition, higher homocysteine levels were
associated with a reduction in basal perfusion of skin capillaries in
men.

Rodrigues et al. (2001) studied the hemodynamically vascular
response to a local reactive hyperemia procedure (ie, tourniquet
cuff maneuver) in two previously selected groups of volunteers
(eight women and eight men). They assessed the effect of sex
under standardized experimental conditions using the transcuta-
neous flow-related variables tcpO₂-tcpCO₂ and laser-doppler
flowmetry. In these experimental conditions, no sex-related in
fluence was found.

Skin color

Fullerton and Serup (1997) studied baseline color in the upper,
middle, and lower levels of the upper back and on the forearms of
168 European volunteers with the Minolta ChromaMeter. These

| Reference            | Number | Age       | Location                        | Measurement Device                                                                 | Male             | Female            | P value   |
|----------------------|--------|-----------|---------------------------------|------------------------------------------------------------------------------------|------------------|------------------|-----------|
| Firooz et al. (2012) | 50     | 10-60 years | right side of forehead, cheek, nasolabial fold, neck, forearm, dorsal side of the hand, palm and leg cheek | Sebumeter, (Courage & Khazaka electronic GmbH, Cologne, Germany). | 60.39±μg/cm² | 42.19±μg/cm² | non-significant |
| Luebbergering et al. (2013) | 300    | 20-74 years | forehead                        | Sebumeter® SM 815; Courage & Khazaka                                             | 84.17±51.15μg/cm² | 48.66±40.53μg/cm² | significant at the cheek for all age groups, and at the forehead for age groups IV and V (p<0.05) |
| Man et al. (2009)    | 713    | 0.5–94 years | forearm, forehead (flexor site) | Sebum Cassette attached to a Courage & Khazaka MPAS system                          | 93.47±9.01μg/cm² | 61.66±6.12μg/cm² | Significant |
| Jacobi et al. (2005) | 6 men  | 24.2±0.4 years | flexor forearm                   | sebumeter SM 810 (Courage & Khazaka, Cologne, Germany)                            | 3.0±0.46 μg/cm² | 0.7±0.5μg/cm²  | non-significant (p>0.05) |
| Kim et al. (2006)    | 46 women 37 men | 21-37 y 23-29 y | five facial sites: nose tip, chin, forehead, right cheek, left cheek | Sebumeter SM 815® (Courage & Khazaka, Koln or Cologne, Germany)                  | not available   | not available | significantly higher in males |
two sites are usually used in skin testing. Female participants showed a generally lower basal a* level than male participants, both on the upper back and forearm skin (a* value is the chromacity coordinates and represents the balance between green [negative values] and red [positive values]). Therefore, when planning irritancy studies where sex-related variations in the skin pigmentation of 497 Korean male subjects (male: 214.82; female: 176.82). Roh et al. (2001) studied sex-related variations in the skin pigmentation of 497 Korean male subjects (male: 214.82; female: 176.82). Roh et al. (2001) studied sex-related variations in the skin pigmentation of 497 Korean male subjects (male: 214.82; female: 176.82). Roh et al. (2001) studied sex-related variations in the skin pigmentation of 497 Korean male subjects (male: 214.82; female: 176.82).

In another comparative Asian study of skin color by sex, the skin of female participants was less erythematous above that of male skin (having a higher redness index). (Li et al., 2014). In an Asian comparison of melanin/erythema by sex, the skin of female participants was less erythematous above that of male skin (having a higher redness index). Microsoft Teams (2019). In the first decade. Also, women had significantly lighter constitutive pigmentation than men except during the first decade. Many artists in various cultures of the world have made their female models lighter skinned than male models. There is a biologic truth behind this. Several spectrophotometric studies have shown that in diverse populations in Europe, Asia, Africa, and North and South America, female skin reflectance is 2 to 3 percentage points above that of male skin (having a higher reflectance means having paler skin.); (Tegner, 1992). In an Asian comparison of melanin/erythema by sex, the skin of female participants was less erythematous on exposed sites (Li et al., 2014).

### Skin elasticity

Firooz et al. (2012) reported that skin elasticity was higher in female subjects than in male subjects; however, the difference was not statistically significant (male: 0.27; female: 0.273). Ishikawa et al. (1995) and Ezure et al. (2011) reported that skin elasticity properties

| Table 4 | Skin thickness in male versus female skin |
| --- | --- | --- | --- | --- | --- |
| Reference | Number | Age | Location | Measurement Device | Male | Female | P value |
| Bailey et al. (2012) | 88 | 18-61 years | forehead, midcheek, jowl, neck, abdomen | DermaScan C 20 MHz (Cyberderm, Broomall, PA) | men had an overall 10-20% thicker than women (Figure 1) | p<0.003 |
| Sandby-Moller et al. (2003) | 71 | 20-68 years | forearm dorsal shoulder buttok | calibrated square grid after biopsy | not available | not available | significantly higher in men (p<0.0001) (Thickness of the cellular epidermis) |
| Mayrovitz et al. (2012) | 30 men | 25.6 ± 2.9 years | Forehead | MoistureMeter-D (Defin Technologies Ltd, Kuopio, Finland) | 39.6 ± 2.7 TDC unit | 37.4 ± 3.3 TDC unit | p=0.001 |
| | 30 women | 26.3 ± 4.4 years | cheek | | 35.9 ± 4.9 TDC unit | 32.8 ± 3.8 TDC unit | p=0.009 |
| | | | forearm | | 31.5 ± 3.2 TDC unit | 28.3 ± 2.4 TDC unit | p<0.001 |
| Mayrovitz et al. (2010) | 30 men | 25.0 +/- 2.5 y | volar forearm | Tissue dielectric constant (TDC) measurements at 300 MHz via the coaxial line reflection method using a probe with an effective measurement depth of 1.5 mm, high frequency ultrasonography using 22 and 50 MHz probes | 33.2 +/- 4.0 TDC unit | 29.4 +/- 2.7 TDC unit | p<0.001 |
| Firooz et al. (2017) | 30 | 24-61 y | cheek, neck, palm, sole, dorsum of foot | not available | not available | significant in neck and dorsum of foot (p<0.05) |

### Table 5

| pH in male versus female skin |
| --- | --- | --- | --- | --- | --- |
| Reference | Number | Age | Location | Measurement Device | Male | Female | P value |
| Bailey et al. (2012) | 88 | 18-61 years | forehead, midcheek, jowl, neck, abdomen | pH meter PH905 attached to Derma Unit SSC3 (CK Electronic, Koln, Germany) | not available | not available | not available |
| Luebberding et al. (2013) | 300 | 20-74 years | forehead, cheek, neck, volar forearm and dorsum of hand | pH meter (pH 90, Schwarzhaupert, Medizintechnik, Germany) | not available | not available | not available |
| Giusti et al. (2001) | 70 | 8 to 24 months | volar forearm button | pH meter (pH 90, Schwarzhaupert, Medizintechnik, Germany) | not available | not available | not available |
| Fox et al. (1998) | 40 | very low birth weight infants over the first month of life | not available | a glass flat-surface pH electrode | Figure 2 | 6.40 | 6.10 | significant |
| Ehlers et al. (2001) | 6 men 5 women | 31-59 years 26-54 years | flexor surface of the forearm | a skin pH meter (pH meter 1140; Mettler Toledo, Greisensee, Switzerland) | not available | not available | not available |
| Kim et al. (2006) | 46 women 37 men | 21-37 years 23-29 years | five facial sites, T-Zone, U-zone | Skin-pH-Meter PH 905® (Courage & Khazaka, Koln, Germany) | not available | not available | not available |
were not correlated with sex. Bailey et al. (2012) reported that elastic deformation was higher in female subjects but only in the skin on the abdomen. Skin stiffness was also higher in female participants, but the difference was only significant in the skin on the abdomen.

Luebberding et al. (2014) selected 300 healthy male and female subjects (age range: 20-74 years) on the basis of age, sun behavior, or smoking habits. Skin mechanical properties were assessed on the cheeks, neck, volar forearm, and dorsum of the hand using a noninvasive suction device. Five parameters were used to assess skin mechanical properties: gross elasticity \((U_a/U_f)\), net elasticity \((U_r/U_e)\), ratio of elastic recovery to distensibility \((U_r/U_f; \text{all in percent})\). Absolute parameters, immediate recovery \((U_r)\), maximum recovery \((U_a)\), skin distensibility, and immediate distensibility (all in \(\mu m\)) were analyzed. They showed that at a young age, the results of the relative parameters are higher for women but the absolute parameters are higher for men. The relative parameters \((U_a/U_f, U_r/U_e, \text{and } U_r/U_f)\) are calculated from the ratio between two distances and are expressed as a percent. The absolute parameters \((U_a, U_r, U_f, \text{and } U_e)\) are single-distance parameters such as stretching or recovery phase and are expressed as micrometers (Fig. 3). The researchers also concluded that the mechanical properties changed differently in men and women over their lifetime and that female skin is less distensible but has a higher ability to recover after stretching in comparison with male skin.

Xin et al. (2010) showed that with aging, cutaneous resonance running time (CRRT) decreased in all directions on the hand, forehead, and canthus. (The measurement of CRRT is a noninvasive approach to assess skin biophysical property that is mainly influenced by collagen fibers in the papillary layers of the dermis and correlates negatively with skin stiffness (Ruvolo et al., 2007; Vexler et al., 1999)). There was a more dramatic reduction in CRRT on the forehead and canthus in both the 2 to 8 and 3 to 9 o’clock directions. In males ages 11 to 20 years, CRRTs were longer than those in females in some directions at all three body sites. CRRTs were longer in women ages 21 to 40 years than in men in some directions of the hand. No sex-related differences were seen in subjects ages 0 to 10 years (except on the canthus) and those age \(>80\) years.

**Skin friction**

Zhu et al. (2011) showed that the maximum skin friction coefficients on the canthus and dorsal hand skin were seen around age 40 years in women, but the skin friction coefficient on the dorsal hand gradually increased from ages 0 to 40 years and then changed little in men. There was a significant positive correlation between skin friction coefficient and stratum corneum hydration on the canthus and dorsal hand skin for women and on the forehead and dorsal hand skin for men. In a comparison of roughness by sex, the skin of female participants was scalier (Li et al., 2014).

**Human face geometry**

Ezure et al. (2011) photographed the faces of 98 healthy Japanese male volunteers in their 20s to 60s at an angle of 45 degrees. They also used photographs of 108 healthy Japanese female volunteers in their 20s to 60s to compare the difference in morphological characteristics of sagging between men and women. They evaluated the sagging severity of the upper and lower cheeks by using photograph-based grading criteria and showed that sagging severity in the upper and lower cheeks was almost equal between men and women of all ages, but after middle age, the sagging of the lower eyelid in men was significantly more severe than that of women. Facial sagging in both men and women had a significantly negative relation with dermal elasticity parameters.

Inoue (1990) showed a significant sex-related difference in the forehead of the skull. For example, the supraorbital ridge was more developed in men than in women and the forehead shape was receding instead of rounded and had a more even surface in women.

**Wrinkles**

Tsukahara et al. (2013) reported that in all age groups of 173 Japanese men and women, men showed increased forehead wrinkles...
compared with women. No sex-dependent differences were found in upper eyelid wrinkles. With the exception of the oldest age group (age: 65–75 years) in which wrinkles in women were greater than or equal to those of men, other facial wrinkles were greater in men in all groups.

Akiba et al. (1999) investigated sex-related differences in sun exposure in subjects <60 years old and suggested that lower levels of sun exposure in women may result in fewer wrinkles. In a comparison study of fine lines by sex, the skin of female participants was shown to be smoother (Li et al., 2014).

Conclusions

Several studies have compared the biophysical properties of the skin between men and women. For some parameters, the same results were generally reported. For example, sebum content is higher in men because sebum is highly influenced by sex hormones. Also, skin pigmentation and thickness are significantly higher, facial wrinkles are deeper, and facial sagging is more prominent in the lower eyelids of men, but there is no significant difference in skin elasticity between the sexes.

On the other hand, the results on other parameters are conflicting, which might be due to differences in study design, measurement devices, sample size, measuring site, environmental conditions, and the genetic backgrounds of the subjects. These differences should be taken into account when designing clinical studies and when prescribing topical products to treat patients.

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