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Extrinsic skin ageing in German, Chinese and Japanese women manifests differently in all three groups depending on ethnic background, age and anatomical site

Andrea Vierkötter[a,1], Anke Hüls[a,1], Ai Yamamoto[b], Sabine Stolz[a], Ursula Krämer[a], Mary S. Matsui[c], Akimichi Morita[b], Sijia Wang[d,e,f], Zhiwen Li[g], Li Jin[d,e,f], Jean Krutmann[a,1,*], Tamara Schikowski[a,1]

[a] IUF-Leibniz Research Institute for Environmental Medicine, Düsseldorf, Germany
[b] Department of Geriatric and Environmental Dermatology, Nagoya City University Graduate School of Medical Sciences, Nagoya, Japan
[c] The Estee Lauder Companies Inc, Melville, NY, United States
[d] Chinese Academy of Sciences Key Laboratory of Computational Biology, Chinese Academy of Sciences – Max Planck Partner Institute for Computational Biology, Shanghai Institutes of Biological Sciences, Shanghai, China
[e] China Medical City Institute of Health Sciences, Taizhou, China
[f] Minister of Education Key Laboratory of Contemporary Anthropology, School of Life Sciences, Fudan University, Shanghai, China
[g] Institute of Reproductive & Child Health/Ministry of Health Key Laboratory of Reproductive and Child Health, School of Public Health, Peking University, Beijing, China

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ABSTRACT

Background: It has been suggested that extrinsic skin ageing manifests differently in Caucasians versus East Asians. In particular, from previous studies it was concluded that Caucasians are more prone to develop wrinkles, whereas pigment spot formation is the hallmark of extrinsic skin ageing in East Asians. However, these assumptions are based on a very limited number of studies which did not include different East Asian populations.

Objective: We here compare the manifestation of extrinsic skin ageing signs in German, Japanese and Chinese women by specifically elucidating the age and anatomical site dependence of any potential ethnic difference.

Methods: In the present study, we assessed skin ageing in N = 902 German, N = 165 Japanese and N = 1260 Chinese women ranging from 30 to 90 years by means of SCINEXA™. Linear regression analysis was used to test for ethnic differences and their age and site dependence adjusted for educational level, sun exposure, smoking and sun protection behaviours.

Results: Pigment spots and wrinkles on the face were present among all three ethnic groups and differences were influenced by age and anatomical sites independently of further influencing factors. Pigment spots on the forehead were most pronounced over the whole age range in Chinese and German women and least developed in Japanese. Pigment spots on cheeks were a typical extrinsic skin an ageing sign in the two East Asian populations in all age groups. However, in older German women they reach the same level as observed in the two East Asian populations. In contrast, pigment spots on arms and hands were significantly more pronounced in German women ≥45years of age. Wrinkles were not exclusively a skin an ageing sign of German women, but were also very pronounced in Chinese women on forehead, between the eyebrows and in the crow's feet area.

Conclusion: These results corroborate the previous notion that the occurrence of pigments spots and wrinkles is different between Caucasians and East Asians. In addition, this study shows that this difference depends on age and anatomical site and that it also differs between different ethnic groups from East Asia.

* Corresponding author at: IUF–Leibniz Research Institute for Environmental Medicine, Auf'm Hennekamp 50, 40225 Düsseldorf, Germany.
E-mail address: Jean.Krutmann@iuf-duesseldorf.de (J. Krutmann).

[1] These authors equally contributed to this work.

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1. Introduction

Ageing of the skin is influenced by two separate processes. The general ageing process, which is genetically determined and occurs over time alone, is called the intrinsic skin ageing process, whereas the skin ageing process induced by environmental factors is termed the extrinsic skin ageing process. Prominent manifestations of the extrinsic skin ageing process are coarse wrinkles, solar elastosis and pigment irregularities [1]. It has been suggested that extrinsic skin ageing manifests differently in different ethnic groups [2–4]. Accordingly, Caucasians were reported to have an earlier onset of skin wrinkling and a more severe manifestation of wrinkles than East Asians [2–4]. In contrast, East Asians were found to show increased hyperpigmentation [2–4]. These differences might be attributed to intrinsic (genetic) or extrinsic (environmental) factors [5–9]. The most obvious intrinsic factor is the genetically determined skin color, which originates from an ethnic variation in melanin content and composition [5]. It has been shown that constitutive pigmentation influences the ethnic difference in the incidence of pigmentation disorders [6] and the visible signs of skin ageing, including skin wrinkling [7]. Other underlying causes might be further genetic variations beyond genes encoding skin color and/or different exposure habits to environmental factors, which influence skin ageing [2]. In this regard, we previously showed that a significant part of the ethnic difference in skin wrinkling manifestation between German and Japanese women can be explained by differences in sun exposure, smoking behaviour, and blood carotene content [8]. We also found that differences in the occurrence of pigment spots between Japanese and German women may be explained at least partially by differences in the distribution of a genetic marker in the *SLC45A2* gene, which is involved in melanin synthesis [9].

As a note of caution, however, it needs to be stated that the overall assumption that skin ageing manifests in Caucasians *versus* East Asians in an ethnic-specific manner, is based on a very limited number of studies (n = 3) [3,4,8]. Given the increasing interest in genetic determinants of skin phenotypes in general and gene/environment interactions in particular it thus appears that there is a need for validation studies involving larger cohorts of different ethnic backgrounds which ideally would use the same evaluation instrument for skin ageing manifestation.

Therefore, we here conducted the largest study, a total of 2326 women of three different populations (German, Chinese and Japanese) in order to systematically investigate the ethnic-specific manifestation of extrinsic skin ageing, with a special emphasis on its age and anatomical site dependence.

2. Material and methods

2.1. Study design and study populations

For the present analysis, we made use of three ethnically different populations which we had previously investigated in four independent studies, which are: (i) The **S**tudy of the influence of **A**ir pollution on **L**ung function, **I**nflammation and **A**geing (SALIA), which includes German women living in the Ruhr Area, (ii) the study of extrinsic skin ageing of **JA**panese and **GE**rman women (JAGE), which assessed Japanese women living in Nagoya (Japan) and German women living in Duisburg (Germany) and (iii) the Taizhou study as well as (iv) the Pingding study, which investigated Han-Chinese women from either Taizhou or Pingding (China). Specifically, skin ageing assessment was performed in the follow-up 2008/2009 of the SALIA study and included N = 806 elderly German women. Detailed descriptions of the SALIA study can be found in Schikowski et al. [10] and Voussoughi et al. [11]. The JAGE study was performed in 2011/2012 and included N = 96 German women and N = 165 Japanese women in the age from 30 to 70 years. Han-Chinese women aged 30–90 years were assessed in context of a study located in Taizhou near Shanghai in Jiangsu province (Taizhou study, N = 857) and in a second study located in Pingding near Beijing (Pingding study; N = 403). The latter two studies were conducted in 2012/2013. A detailed description of the Taizhou and the Pingding studies can be found in Wang et al. [12] and Li et al. [13]. In all studies, we applied the same instrument for skin ageing evaluation. All studies were approved by the respective human ethics committees and the Declaration of Helsinki Principles was followed. All study subjects were informed in detail by written form and gave written consent.

2.2. Assessment of skin ageing symptoms

Assessment of skin ageing was conducted in a standardised manner according to a protocol which was identical for all four studies. In brief, skin ageing symptoms were visually evaluated by applying the skin ageing score SCINEXA™ (SCore of INtrinsic and EXtrinsic skin Ageing) [14–16]. SCINEXA™ comprises a set of extrinsic and intrinsic skin ageing symptoms. However, we here only evaluate the extrinsic skin ageing signs pigment spots and coarse wrinkles as these are the signs, which seem to manifest in an ethnic-specific manner. Pigment and wrinkle scores were assessed with scores ranging from 0 (not present) to 5 (very severely present) according to photo-reference scales [3]. The pigment score refers to the size of the spots, whereas the wrinkle score refers to the severity of wrinkles in respect of their number, depths and length. Additionally, the number of pigment spots was evaluated as 0 = 0 pigment spots, 1 = 1–10 pigment spots, 2 = 11–50 pigment spots, 3 = more than 50 pigment spots. Before the assessment the face was cleaned and adapted to room temperature for 15 min and during the assessment the subjects were instructed to close their eyes and relax their face. In the SALIA study the SCINEXA™ evaluation was performed by A.V. In the other studies, each subject was examined on site by a dermatologist or study nurse, who had been trained prior to study start by A.V. in the correct use of SCINEXA™. In addition to the on-site assessment of SCINEXA™ scores, digital color photographs of participants were taken by a trained photographer in the Taizhou and Pingding studies. These photographs were used for quality controls, in which skin ageing manifestation was evaluated a second time by an independent trained dermatologist or study nurse. In the cases of (i) a scoring difference between the on-site scoring and the scoring of photographs larger than 1 or (ii) a disagreement for yes/no answers, the trainer (A.V.) of the SCINEXA™ decided the final score. Furthermore A.V. gave feedback to the on-site scorers how to evaluate the specific skin ageing trait correctly. As a result of this procedure the scores of the on-site scorers deviated from each other in less than 10% of the cases.

2.3. Statistical analysis

We pooled the German women from two studies (SALIA, JAGE) to one German population and the Chinese women from two studies (Taizhou, Pingding) to one Chinese population. Japanese women were only investigated in the JAGE study. Skin ageing manifestation was then described for each ethnic group (German, Japanese, Chinese) and further for three different age groups: (30–45) years, (45–60) years and (60–90) years of age separately. As the distribution of wrinkle and pigment scores were normally distributed, arithmetic means (AM) were calculated. The distribution of a pigment spot number was log-normally distributed and therefore the geometric means (GM) were given.