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Original Article

Non-invasive indicators of skin aging; A study on the population of Karachi using SCINEXA.

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Abstract

Background: Skin, the most visible human entity, quickly displays emotional, physical, and psychological well-being. Research has shown a linear correlation between both types of skin aging within 30–69 years. Thus, the current research study aimed to highlight the use of SCINEXA, the novel skin aging score, in predicting accelerated biological aging.

Methodology: This cross-sectional study was conducted in Karachi, Pakistan, from 8th October 2021 to 4th December 2021. Both male and female subjects of age groups from 19 to 69 years were included. A novel skin aging score, 'SCINEXA' (Score of Intrinsic and Extrinsic Skin Aging), was used to assess skin aging. Both extrinsic and intrinsic signs were analyzed in terms of pigmented spots, coarse wrinkles, solar elastosis, telangiectasia, and laxity & seborrheic keratosis, respectively.

Results: The SCINEXA score indicated that 91.3% of participants had low aging signs and decreased pigmentation, while 2.9% had relatively high pigmentation on the forehead, cheek, forearm, and back of the hand. Coarse Wrinkles of grade 5 on the forehead were present among 19.7% of individuals, and 20.6% showed the same in the crow feet area. The skin aging symptoms are most significantly associated with age ($p<0.05$).

Conclusion: Accelerated biological aging is not found in the studied population using the SCINEXA tool; therefore, the studied population's skin has been found resilient to photo-aging.

Keywords

Aging, SCINEXA, Skin Aging, Pigmentation, Accelerated Aging, Wrinkles.

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Introduction

Skin, the most visible human entity, quickly displays emotional, physical, and psychological well-being. In other words, skin acts as an envelope of oneself and is the visible manifestation of personal identity[1]. With age, the skin becomes more wrinkled, thinner, sagged, rougher, and less elastic[2]. Therefore, skin aging directly influences the self-esteem of people. Low self-esteem might cause depression, anxiety, psychosocial disturbances, and even social withdrawal[2,3]. Even without any disease, aging skin results in an emotional burden whose currency is psychology and not biology[4].

Both extrinsic and intrinsic factors contribute to skin aging. The aging process determines intrinsic, also known as chronological skin aging, with changes occurring over time, while extrinsic aging of the skin is due to chronic exposure to different environmental factors, such as air pollution or ultraviolet (UV) radiation, hence termed as photo-aging[5]. It was highlighted in a study that the use of sunbeds regularly for more than a decade led to extrinsic skin aging and that both types of skin aging were somewhat dependent on each other[6]. Extrinsic skin aging could be determined by clinical symptoms like irregular pigment spots, coarse wrinkles, and elastosis[7]. Exposure to ambient particulate matter (PM) represents a higher risk for pulmonary cancer and cardiovascular diseases through the generation of oxidative stress, which adds to the progression of extrinsic skin aging[8]. Intrinsic aging also results from metabolic oxidative stress[6]. Although in females, hormones are a part of intrinsic skin aging, and the use of Hormone Replacement Therapy (HRT) was associated with better effects[9]. As determined through a study, the mean Skin Age Score was higher in postmenopausal women[10]. It is thought that the decreased estrogen levels after menopause cause a reduction in dermal collagen, thereby leading to skin atrophy[11]. Further, Andrea V (2010)[12] observed that a light skin type had fewer pigment spots, elastosis, and coarse wrinkles but more pronounced telangiectasia[13,14].

Moreover, sleep has a direct association with skin, from which the concept of beauty sleep was derived. A study by Oyetakin-White et al. (2015) found that poor sleepers are directly associated with fine wrinkling, uneven pigmentation, loss of subcutaneous fat, skin laxity, and benign skin growths, thereby impairing skin integrity[15]. A study highlighted the role of stress in skin health[16]. A few research studies revealed that poor sleepers had accelerated intrinsic skin aging resulting in decreased satisfaction with personal appearance and decreased skin barrier function[15,16].

Additionally, genes determine the rate of intrinsic skin aging, whereas extrinsic skin aging is determined by sun exposure, air pollution, and smoking[17-20]. Accordingly, East Asians were reported to have more hyperpigmentation, whereas Caucasians showed wrinkles[20, 21]. Research has shown a linear correlation between both types of skin aging within 30-70 years[22]. Thus, the current research study aimed to highlight the use of SCINEXA, the novel skin aging score, in predicting accelerated biological aging. SCINEXA is a validated non-invasive clinical tool that simultaneously assesses and differentiates between chronological (intrinsic) and photo-aging (extrinsic) factors of skin aging[23].

Methodology

This cross-sectional study was conducted on a total sample of 412 in Karachi, Pakistan, from 8th October to 4th December 2021. The sample was collected from all city districts through a simple random sampling technique.

Both male and female subjects of age range from 19 to 69 years with education completed till college level at least were included in the study. However, exclusion criteria involved ages below 19 and above 69 years, night-shift workers, individuals who have moved into the metropolis in the last five years, and individuals who had been diagnosed with any chronic disease, neurological, hematological, or motor disorder.

This study was conducted according to the principles of the 18th world medical assembly[24],

including all subsequent amendments. It was conducted in compliance with all international guidelines and national laws, as well as any applicable guidelines. Data collectors designated by the investigator fully informed the participants about terms and conditions, objectives, constraints, duration, and participants' rights.

A novel skin aging score, SCINEXA (Score of Intrinsic and Extrinsic Skin Aging)[23], was used to assess skin aging.

It comprises five intrinsic indicative items and 18 extrinsic items of skin aging. These items defined a discriminative index that simultaneously assesses and differentiates between chronological (intrinsic) and photo-aging (extrinsic) skin aging factors. The extrinsic signs analyzed were pigmented spots, coarse wrinkles, solar elastosis, and telangiectasia. The intrinsic signs which were being examined were laxity and seborrheic keratosis. The scoring of SCINEXA is described in Table 1 as described by Vierkotter et al., 2009[23].

Table 1: Applied skin aging score based on SCINEXA (Score of intrinsic and extrinsic skin aging; Vierkotter et al., 2009).

Skin Aging Signs	Localization	Scoring
	Extrinsic Signs	
Pigment Spots[1]	On Forehead	0(0), 1-10 (5), 11-50 (30), >50 (75)
	On Cheeks	
	On Upperside of the Forearm	
	On Back of the hand	
Coarse Wrinkles[2]	On Forehead	Grade 0-5
	Wrinkles in crowfeet area	
	Under the Eyes	
	On Upperlip	
	Nasolabial Fold	
Solar Elastosis	On Cheeks	Yes/No
Telangiestasia	On Cheeks	Grade 0-5
	Intrinsic Signs	
Laxity[2]	Ovality of the face	Grade 0-5
Seborrheic Keratosis[1]	On upper Part of the body	0(0), 1-10 (5), 11-50 (30), >50 (75)

[1]Scoring of spots and Seborrheic Keratosis with counts in parenthesis
[2]Grading with Photo reference scale; 0= Sign absent 5=sign very severely present

The pigmented spots were determined on the forehead of the individuals' cheeks, back of the hands, and on the upper side of the forearm and were graded according to the number of spots present, which is 0, 1-10, 11-50, >50. Coarse wrinkles were inspected on the forehead by asking the subject to make a worried expression to check for their glabellar lines, more commonly called forehead furrows. The subject was asked to smile and giggle to inspect for the wrinkles in the crow's feet area. Next, the wrinkles were detected under the eye by observing the subject during laughing, smiling, furrowing brows, or frowning. Upper lip wrinkles were observed during repetitive facial expressions. Lastly, wrinkles were observed on the nasolabial fold, often called smile or laugh lines. All of the wrinkles observed on the face were graded between 0-5, where 0 is equal to signs completely absent and 5 for signs very severely present. Solar elastosis was observed on the individual subject's cheeks and was marked as yes if the skin was lost and there were fine wrinkles around the cheeks and was noted as no when no signs were present. Lastly, for extrinsic signs, telangiectasia was observed on the cheeks.

It was marked according to the intensity of thread-like red lines or patterns on the cheeks and was graded between 0 (signs not present) and 5 (signs severely present) (Figure 1).

For examining the intrinsic signs, two things were observed. Firstly skin laxity was noticed by observing the loose skin of the face or sagging skin and was graded between 0-5. Secondly, the subject was asked if they had any brown, black, or light tan skin growth on the upper part of the body, and it was marked as yes or no.

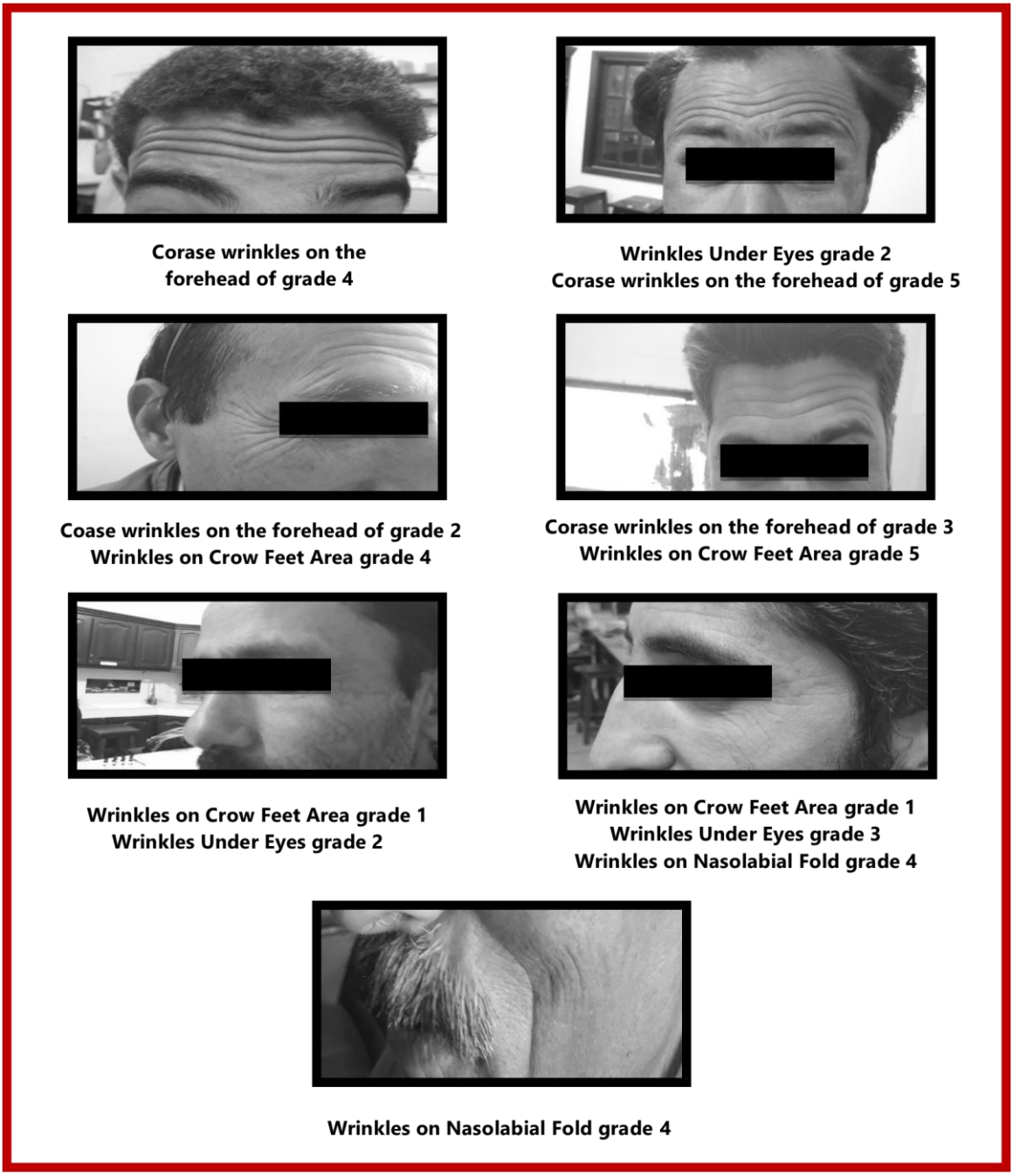

Figure 1: SCINEXA scoring being used to grade Extrinsic Signs of Aging in Participants.

The Statistical Package for the Social Sciences (SPSS) version 22.0 was used for statistical analysis. One-way analysis of variance (ANOVA) was used to determine the age-wise alterations in the aging as depicted by SCINEXA skin aging scores. A p-value of less than 0.05 was considered statistically significant.

Results

The mean SCINEXA scores were differenced based on pigmented spots and coarse wrinkles on the skin. It was found that the mean scoring of pigmented spots on the forehead was 1.17±5.13, and on the cheek, it was 2.18±5.94. The coarse wrinkles were graded from 0 to 5; the mean grade on the forehead was 2.70±1.633 and 2.52±1.41 under the eye. On average, the skin aging scores were normal (displaying fewer signs of skin aging).

Further, the SCINEXA score indicated that 91.3% of participants had low aging signs and decreased pigmentation, while 2.9% had relatively high pigmentation on the forehead, and the same pattern was observed for the cheek, forearm, and back of the hand.

Coarse wrinkles of grade 5 on the forehead were present among 19.7% of individuals, and 20.6% showed the same in the crow feet area. The skin aging symptoms are most significantly associated with age ($p<0.05$). Moreover, older participants from 37 to 53 years or 54 to 70 displayed a greater frequency of coarse wrinkles in grades 3 to 5. Around 15.4% of participants aged 54 to 70 years had grade 5 nasolabial folds, while only 2.9% of 20 to 36 participants were observed with it. Table 2 shows the stratification of non-invasive indicators for age.

Table 2: Stratification of Non-invasive indicators with respect to age (n= 412).

Non-Invasive Indicator (SCINEXA Scores)			Age Groups			p-value
			20 to 36 years	37 to 53 years	54 to 70 years	
Pigmented Spots	Forehead	0(0)	256(87.7)	68(100)	52(100)	0.003*
		5(1-10)	24(8.2)	-	-	
		30(11-50)	12(4.1)	-	-	
		75(>50)	-	-	-	
	Cheek	0(0)	224(76.7)	48(70.6)	40(76.9)	0.030*
		5(1-10)	52(17.8)	20(29.4)	12(23.1)	
		30(11-50)	16(5.5)	-	-	
		75(>50)	-	-	-	
	Forearm	0(0)	288(98.6)	68(100)	52(100)	0.436
		5(1-10)	-	-	-	
		30(11-50)	4(1.4)	-	-	
		75(>50)	-	-	-	
	Back Of Hand	0(0)	288(98.6)	68(100)	48(92.3)	0.000*
		5(1-10)	-	-	4(7.7)	
		30(11-50)	4(1.4)	-	-	
		75(>50)	-	-	-	
Coarse Wrinkles	Forehead	Grade 0	64(21.9)	-	-	0.000*
		Grade 1	28(9.6)	-	-	
		Grade 2	80(27.4)	-	-	
		Grade 3	68(23.3)	25(36.8)	24(46.2)	
		Grade 4	28(9.6)	10(14.7)	4(7.7)	
		Grade 5	24(8.2)	33(48.5)	24(46.2)	
	Crow Feet's Area	Grade 0	64(21.9)	-	-	0.000*

	Grade 1	24(8.2)	-	-	
	Grade 2	92(31.5)	5(7.4)	-	
	Grade 3	64(21.9)	15(22.1)	20(38.5)	
	Grade 4	20(6.8)	15(22.1)	8(15.4)	
	Grade 5	28(9.6)	33(48.5)	24(46.2)	
Under The Eye	Grade 0	28(9.6)	-	-	0.000*
	Grade 1	60(20.5)	-	-	
	Grade 2	108(37.0)	29(42.6)	16(30.8)	
	Grade 3	52(17.8)	15(22.1)	4(7.7)	
	Grade 4	24(8.2)	10(14.7)	8(15.4)	
	Grade 5	20(6.8)	14(20.6)	24(46.2)	
Upper Lip	Grade 0	288(98.6)	68(100)	44(84.6)	0.000*
	Grade 1	4(1.4)	-	-	
	Grade 2	-	-	-	
	Grade 3	-	-	-	
	Grade 4	-	-	4(7.7)	
	Grade 5	-	-	4(7.7)	
Nasolabial Fold	Grade 0	88(30.1)	19(27.9)	4(7.7)	0.000*
	Grade 1	96(32.9)	5(7.4)	12(23.1)	
	Grade 2	64(21.9)	20(29.4)	4(7.7)	
	Grade 3	40(13.7)	15(22.1)	12(23.1)	
	Grade 4	4(1.4)	5(7.4)	12(23.1)	
	Grade 5	-	4(5.9)	8(15.4)	

*Scoring of pigmented spots; 0 means signs not present & 5 means signs significantly present. SCINEXA scores.

Discussion

The results from SCINEXA scores demonstrated that the majority of the study participants (91.3%) showed low aging signs and had decreased pigmentation ($p<0.05$). At the same time, those participants who showed high pigmentation mostly had the same pattern on the forehead, cheek, forearm, and back of the hand (Table 2). The modified scale of SCINEXA used in this study is a non-invasive method that comprises items indicative of chronological skin aging and those that showed characteristics for extrinsic skin aging[23]. SCINEXA scoring suggested that coarse wrinkles were greatly seen in older individuals (37 to 69 years), mostly in the region of the forehead and crowfeet. Vierkötter et al., 2009 in a study reported that older individuals had uneven pigmentation and dryness[23]. The same study's results also suggest that the majority of individuals above the age of 30 show fine wrinkles, and a statistically significant positive association with extrinsic skin aging was reported[14]. Studies have observed that with the progression of chronological age, skin aging signs increase, reflecting the effect of environmental factors on an individual skin associated with age-dependency cumulative changes[25].

Research has shown a linear correlation between both types of skin aging within 30–70 years. In contrast, above 70 years of age, the 24 clinical characteristics of the Skin Age Score were common among all individuals. Hence, the calculated biological skin age for all those was the same[22]. Further, exposure to ambient particulate matter (PM) represents a higher risk for pulmonary cancer and cardiovascular disease generation of oxidative stress, which adds to the progression of extrinsic skin aging[8]. Intrinsic aging also results from metabolic oxidative stress[6].

The current results suggested that 91.3% of the study participants had low aging signs and decreased pigmentation, while only 2.9% had high

pigmentation (Table 2). This suggests that, on average, the aging skin score of the study participants was normal, and the skin composition of the studied population has been found resilient to it.

Although, exposure to environmental factors, including long-term exposure to sun and particulate matter, can contribute to skin photo-aging. A study conducted by Fros et al. in 2018 determined that the SCINEXA score was productive in determining the skin damage caused by sunlight in the specific region of Ecuador, specifically on non-Caucasian South American individuals[26]. Similarly, in another study, SCINEXA predicted accelerated skin aging associated with poor sleep quality in Caucasian women[27]. Thus it could be predicted that SCINEXA skin aging score tool shows that skin of people in Karachi is more resilient to photo aging than the Caucasian population. This might be due to the fact that Asians' skin does not show epidermal atrophy as a result of photo-aging, earlier pointed out in a study conducted in Rawalpindi, Pakistan, which concluded that the epidermal thickness remains the same with the advancing age and also the extrinsic and intrinsic factors of skin aging does not have any pronounced effect on the thickness of the epidermis and dermis, thereby providing a protective effect against aging. Thus, the absence of thinning of the epidermis with age could be the reason why accelerated skin aging was not observed in study participants of Karachi[28]. The white-skinned population is much more prone to photo-aging due to a lack of melanin which provides a protective effect, therefore are more severely affected by the sun than those with darker skins[29].

Moreover, considering the ultra-structural level of the skin, there is evidence of rete pegs flattening, accompanied by basement membrane components' general disorganization leading to significantly increased skin fragility[30]. For instance, in the skin of the Caucasian population, the epidermal thickness does not vary. However, the dermo-epidermal junction got flattened with advancing age, making the skin less resistant to photo aging and more vulnerable to skin aging factors[31]. This factor might be responsible for preventing photo-aging of the South East Asian population.

This study determines that individuals of the study population do have effects of photo-aging, but these are not as pronounced as in the non-South East Asian population. The absence of definite photo-aging suggests that it cannot be considered an indicator of accelerated aging. Other similar studies conducted by Mirza et al. in 2020 determined that grip strength, altered olfaction, obesity, and HbA1c as the possible indicators assess the accelerated biological aging in the population of Karachi, Pakistan[32, 33].

Conclusion

This study concluded that intrinsic and extrinsic signs of skin aging are not much evident in the studied population. Thus, accelerated biological aging of skin has not been proved in the studied population using the SCINEXA tool, and therefore, the studied population has been found resilient to it.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this study.

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