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Original Article

Factors Associated with Skin Aging in Adults Over Forty-five

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Abstract

Background: Skin aging signs affect body image satisfaction and decrease self-confidence and self-esteem.
Objective(s): The present study aimed to assess factors associated with skin aging among community-dwelling adults over forty-five years.
Methods: This cross-sectional study enrolled 360 individuals aged above forty-five years. Participants were recruited from various social clubs in Alexandria. Structured interviews were conducted to gather socio-demographic information, medical history, personal habits, and lifestyle factors that are possibly associated with skin aging. Skin aging was clinically evaluated using the Skin Aging Score.
Results: Most participants had pigmented spots on their forehead and cheeks (87.8% and 90.8%, respectively). Fine lines (89.4%), nasolabial folds (90.6%), crow's feet (90.3%), and wrinkles under the eyes (98.3%) were prevalent among the majority with tissue slackening being marked in 77.5% of participants. Results of linear regression analysis showed that, eight variables proved to be significant predictors of skin aging among the study sample; age (B=0.16, p <0.001), being widowed (B=2.00, p= 0.01), sleeping less than 6 hours per day (B=2.35, p= 0.02), daily intake of more than one spoon of sugar (B= 1.42, p= 0.01), daily intake of less than 8 cups of water (B=2.81, p <0.001), smoking (B= 3.59, p <0.001), frequent sun exposure (B=2.00, p <0.001) and sun exposure from 12 pm to 4 pm (B= 1.82, p <0.001).
Conclusion: This study highlights the importance of lifestyle factors in skin aging among individuals above forty-five years. Implementing strategies to promote healthy habits may help mitigate skin aging effects.

Keywords: skin aging, lifestyle factors, health behaviours

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INTRODUCTION

Aging is an inevitable, continuous degenerative process that affects all the body systems among all individuals. With the increased life expectancy, the desire to look youthful and younger has increased. Skin aging is present in nearly all the elderly, unlike other comorbidities which are found in certain individuals, making skin aging of great public health concern [(1)].

Skin aging occurs due to several changes throughout the skin layers such as thinning of the epidermis and stiffness of collagen, as well as distortion and fragmentation of elastic fibres, leading to reduced elasticity [(2)]. There are several skin aging signs as dryness, skin fragility, liability to bruising, telangiectasia, pale skin, loss of rejuvenation, skin and eyelid sagging, wrinkles, hyperpigmentation as age spots, milia formation and comedones formation [(3)]. These signs were included in different scales to measure skin aging as Skin aging score (SAS) [(4)], SCore of INtrinsic and EXtrinsic skin Aging (SCINEXA) scale [(5)], and Global Subjective Skin Aging Assessment score [(6)].

The skin aging exposome consists of the internal and external factors, as well as their interactions, that have an impact on the life of the individual from conception till death. It also includes the reaction of the body to these factors that cause both biological and clinical skin aging signs [(7)] Skin aging exposome can also refers to the risk factors for skin aging. There are several risk factors for the most important of which are: sun radiation, air pollution, tobacco smoke, nutrition, stress and sleep deprivation [(2)].

Skin aging signs can have significant psychosocial implications, impacting body image satisfaction, self-confidence, and self-esteem [(8)]. Notably, no studies in Egypt have assessed skin aging and skincare practices in adults. The current study was designed to assess skin aging changes among individuals aged above forty-five years and to explore factors associated with skin aging.

METHODS

Study design, settings and target population

A cross-sectional study design was used to recruit people over 45 years old who were members of social and syndicate clubs in Alexandria city, did not have communication issues, and agreed to take part in the study. Individuals who had undergone recent cosmetic procedures (within the last year), had skin diseases, or had long-term illnesses that had secondary skin symptoms (such as chronic liver disease or chronic renal failure) were not included. Two social clubs and six syndicate clubs were visited, with the sample size proportionally allocated according to the total number of adults enrolled in each club. The study was carried out between February 2021 and October 2021.

Sample size

Based on a previous study [9], the prevalence of low skin care practices was 65.0%, using a margin of error 5%, alpha error of 0.05% the minimum sample size required was 349. A total number of 360 individuals were included in the study.

Data collection tools

1. **A pre-designed structured interview questionnaire was used to collect the following data:**
   - Socio-demographic data: age, gender, marital status, education, income and occupation.
   - Medical history: presence of chronic diseases and number of medications taken daily.
   - Personal and lifestyle habits related to skin aging: smoking, physical activity, sleep habits (daily hours of sleep and presence of sleep problems), dietary habits (frequency of intake of processed meat, food rich in trans-fat, sweets, fruits and vegetables, sugar and water) and sun exposure (frequency and time of exposure) and regular sunscreen use.
2. **Skin Aging Score (SAS) [4]:** It is a valid, reliable 24-item scale used to assess skin aging changes by clinical evaluation. It was developed using analysis of data from the relationship between skin aging signs and the chronological age. SAS evaluates the visual skin features for skin aging signs. The total of 24 skin aging signs are split into 6 groups by presumed common etiology: milia, comedone, wrinkles, inability to redness, sagging and pigment spots. It is used to rate most of the skin characteristics as absent=1, slight=2 or very marked=3. The higher the score, the more skin aging signs are present.

A pilot study (n=20) was carried out to determine face validity and to test the feasibility and comprehensibility of the questionnaire.

Statistical analysis

The collected data was analyzed using IBM SPSS version 25 (SPSS, Inc., Chicago, IL). The data was tested for normality using the Kolmogorov-Smirnov test and was found to be normally distributed. Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequencies and percentages. To compare the mean skin aging score across different independent variables, independent Student's t-test and ANOVA (Analysis of Variance) were employed. Multiple linear regression analysis was conducted to predict variables associated with skin aging, including all significant variables identified in the bivariate analysis. All statistical tests were two-tailed, and a p-value less than 0.05 was considered statistically significant.

Ethical considerations

Approval of the proposed study was granted by the research ethics committee of the High Institute of Public Health, Alexandria University in Egypt. All methods were carried out in accordance with the international research guidelines and the Declaration of Helsinki. To ensure ethical standards were met, all participants were provided with written consent, and were informed that participation was wholly voluntary. Furthermore, participants were reassured that the information collected would be kept confidential.

RESULTS

The study sample included 360 individuals; 278 were females (77.2%). Their age ranged from 46 to 83 years; with a mean age of 55.46±7.98 years. More than two thirds of the study sample was married (71.7%) and most of the study participants (85.6%) were either university graduates or had a postgraduate degree. More than half of the sample (54.2%) were working and most of them (80.8%) reported that their income was just enough. More than two thirds of the study sample (72.5%) were suffering from one or two chronic diseases and 36.0% of them were taking 3-4 medications per day **(Table 1).**

The mean Skin Aging Score (SAS) was 52.71±5.65, ranging from 40 to 66. Most participants didn't have blackheads or whiteheads on the cheeks or forehead (82.2% - 91.1%). Similarly, the majority did not have milia on these areas (82.8% - 85.3%). However, many had pigmented spots on the cheeks and forehead (90.8% - 87.8%). The cheeks of 78.3% of participants and foreheads of 90.5% did not redden when pinched. Fine lines were prevalent on the cheeks and forehead for 81.4% and 89.4% of participants, respectively, with more than half having coarse wrinkles on the cheeks (60.0%). Nasolabial folds, crow's feet, and wrinkles under the eyes were very marked in the majority (90.6%, 90.3% and 98.3% respectively). Tissue slackening was very marked in 77.5% of participants, while drooping eyelids

and slight bags under the eyes were less prevalent (46.7% - 43.3%). Cheek and forehead elasticity were predominantly flaccid (75.5% - 67.2%) **(Table 2).**

Table 1: General characteristics of a sample of community-dwelling adults over forty-five in Alexandria, Egypt

Variable	Adults over 45 years (n= 360) No.	%
Age (years)		
46-55	200	55.6
56-65	103	28.6
66-75	44	12.2
76-83	13	3.6
Mean ± SD	55.46 ± 7.98	
Gender		
Males	82	22.8
Females	278	77.2
Marital status		
Married	258	71.7
Widowed	52	14.4
Divorced	34	9.5
Single	16	4.4
Education		
Secondary or technical diploma or lower	52	14.4
University/postgraduate	308	85.6
Occupation		
Not working/housewives	165	45.8
Professional	112	31.1
Semi-professional	46	12.8
Non-professional	37	10.3
Income		
Not enough &borrowed	23	6.4
Just enough	291	80.8
Enough &saves	46	12.8
Number of chronic diseases		
0	84	23.3
1-2	261	72.5
3-4	15	4.2
Number of medications taken daily		
0	80	22.1
1-2	95	26.4
3-4	129	36.0
5+	56	15.5

Age was significantly associated with the Skin Aging Score (SAS), showing a statistically significant increase as age increased (p <0.001). Males had a slightly higher SAS than females (53.25±6.08 and 52.55±5.51, respectively), but this difference was not statistically significant (p=0.32). Marital status was also significantly associated with SAS (p=0.01), with widowed individuals having the highest SAS (55.03±4.82) and married individuals having the lowest (52.24±5.67). Education level showed no significant difference in SAS (p=0.78). Income level was significantly associated with SAS (p=0.02), with those who had insufficient income and borrowed money having the highest SAS (55.60±6.84), followed by those with just enough income (52.63±5.65) and those with enough income and savings (51.71±4.45) **(Table 3).**

Current smokers had a significantly higher SAS score (56.41±5.13) compared to ex-smokers (52.61±5.07) and non-smokers (51.81±5.43), with a statistically significant difference (p <0.001). However, the practice of sports did not significantly affect SAS scores. Regarding sleep habits, individuals who used to sleep less than 6 hours per day had a higher SAS (53.92±5.12) compared to those used to sleep from 6 to 8 hours (52.54±5.65), while those who used to sleep more than 8 hours per day had the lowest SAS (49.82±6.29). These differences were statistically significant (p <0.001). However, the presence of sleep problems was not significantly associated with SAS (p= 0.38) **(Table 3).**

Higher intake of processed meat, sweets, and carbohydrates was significantly associated with a higher mean SAS (55.67±5.12, 54.51±6.70, and 53.13±5.43 respectively) compared to lower intake (p <0.001, and 0.03 respectively). Conversely, higher intake of fruits and vegetables, fresh juices, and green tea was associated with the lowest mean SAS (52.54±5.92, 52.69±5.49, and 52.21±5.66 respectively) compared to lower intake, although these differences were not statistically significant (p=0.27, 0.21, and 0.35 respectively). Moreover, high sugar

intake was significantly associated with a higher mean SAS (55.13±6.65) compared to low intake (p <0.001). Conversely, the lowest intake of water was significantly associated with the highest mean SAS (54.82±3.93) compared to higher intake (49.15±3.42, p <0.001) **(Table 3).**

Regarding sun exposure, individuals exposed daily to the sun had the highest SAS (54.27±5.51), while those not exposed had the lowest SAS (49.08±7.68), with statistically significant differences (p <0.001). Additionally, individuals who are frequently exposed to the sun from 12 pm till 4 pm had the highest SAS (54.23±4.78) compared to those exposed at other times, and this difference was statistically significant (p <0.001). There were no significant differences in SAS found among individuals who followed a regular skin care regimen or used sunscreen regularly **(Table 3).**

Results of linear regression analysis **(Table 4)** showed that, 8 variables proved to be significant predictors of skin aging among the study sample; the age (B=0.16, p <0.001), being widowed (B=2.00, p= 0.01), sleeping less than 6 hours per day (B=2.35, p= 0.02), the daily intake of more than one spoon of sugar (B= 1.42, p= 0.01), the daily intake of less than 8 cups of water (B=2.81, p <0.001), smoking (B= 3.59, p <0.001), frequent sun exposure (B=2.00, p <0.001) and sun exposure from 12 pm to 4 pm (B= 1.82, p <0.001).

Table 2: Distribution of a sample of community-dwelling adults over forty-five in Alexandria, Egypt according to their Skin Aging Score

Skin Aging signs	Adults over 45 years (n=360)					
Comedones	**Absent**		**Hardly visible**		**Visible**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Blackheads on cheeks	296	82.2	15	4.2	49	13.6
Blackheads on forehead	299	83.0	15	4.2	46	12.8
	Absent		**Present**			
	No.	**%**	**No.**	**%**		
Whiteheads on cheeks	326	90.6	34	9.4		
Whiteheads on forehead	328	91.1	32	8.9		
Milia						
Milia on cheeks	298	82.8	62	17.2		
Milia on forehead	307	85.3	53	14.7		
Inability to redness						
Cheek inability to redden	78	21.7	282	78.3		
Forehead inability to redden	34	9.5	326	90.5		
	Absent		**A few**		**Many**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Pigmented spots						
Pigmented spots on cheeks	33	9.2	165	45.8	162	45.0
Pigmented spots on forehead	44	12.2	172	47.8	144	40.0
Wrinkles						
Fine lines on cheeks	23	6.4	44	12.2	293	81.4
Fine lines on forehead	6	1.7	32	8.9	322	89.4
Lines on lips	19	5.3	66	18.3	275	76.4
Wrinkles on upper lips	23	6.4	61	16.9	276	76.7
	Absent		**Slight**		**Very marked**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Coarse wrinkles on cheeks	75	20.8	69	19.2	216	60.0
Furrows between eyebrows	10	2.7	29	8.1	321	89.2
Nasolabial folds	0	0.0	34	9.4	326	90.6
Crow's feet	12	3.3	23	6.4	325	90.3
Wrinkles undereye	2	0.6	4	1.1	354	98.3
Sagging						
Tissue slackening	14	3.9	67	18.6	279	77.5
Drooping eyelids	94	26.1	98	27.2	168	46.7
Bags under eyes	114	31.7	156	43.3	90	25.0
	Supple		**In-between**		**Flaccid**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Cheek elasticity	11	3.1	77	21.4	272	75.5
Forehead elasticity	18	5.0	100	27.8	242	67.2
Range of SAS= 40-66						
Mean±SD = 52.71±5.65						

SD Standard Deviation

Table 3: Univariate analysis of possible factors associated with skin aging score among sample of community-dwelling adults over forty-five in Alexandria, Egypt (n=360)

Variable	Skin aging score Mean ± SD	P value
Age (years)		
46-55	51.58±5.52	
56-65	53.70±5.54	
66-75	54.66±5.33	<0.001*
76-83	55.62±5.64	
Gender		
Males	53.25±6.08	0.32
Females	52.55±5.51	
Marital status		
Married	52.24±5.67	
Widowed	55.03±4.82	0.01*
Divorced	52.91±5.36	
Single	52.31±6.78	
Education		
Secondary or technical diploma or lower	52.92±6.11	0.78
University/postgraduate	52.67±5.57	
Occupation		
Not working/housewives	53.51±5.58	
Professional	51.79±5.31	0.05
Semi-professional	52.89±6.06	
Non-professional	51.67±5.99	
Income		
Not enough &borrowed	55.60±6.84	0.02*
Just enough	52.63±5.65	
Enough &saves	51.71±4.45	
Number of chronic diseases		
0	51.90±4.79	0.13
1-2	52.90±5.92	
3-4	53.93±4.78	
Number of medications taken daily		
0	51.52±5.44	
1-2	53.05±5.73	0.18
3-4	52.91±5.43	
5+	53.35±6.14	
Practicing regular sports (at least three times/week)		
Yes	52.34±5.81	0.38
No	52.89±5.56	
Smoking status		
Non-smokers	51.81±5.43	<0.001*
X-smokers	52.61±5.07	
Current smokers	56.41±5.13	
Number of sleep hours per day		
< 6 hours	53.92±5.12	<0.001*
6-8 hours	52.54±5.65	
> 8 hours	49.82±6.29	
Sleep problems		
Yes	52.99±5.95	0.38
No	52.47±5.37	
Intake of food rich in trans-fat		
Always	52.57±6.22	
Sometimes	52.73±5.45	0.97
Never	52.77±5.64	
Intake of processed meat		
Always	55.67±5.12	
Sometimes	52.35±5.67	<0.001*
Never	52.29±5.38	
Intake of sweets		
Always	54.51±6.70	<0.001*
Sometimes	52.15±4.94	
Never	52.05±7.73	
Intake of fruits and vegetables		
Always	52.54±5.92	0.27
Sometimes	52.96±4.78	
Never	56.40±6.26	
Intake of daily sugar spoons		<0.001*

1 spoon	51.43±5.15	
2-3 spoons	52.54±5.06	
> 3 spoons	55.13±6.65	
Daily intake of water		
1-2 cups	54.82±3.93	
3-5 cups	53.39±6.40	<0.001*
6-8 cups	52.07±5.04	
> 8 cups	49.15±3.42	
Following a skin care regimen		
Daily	53.08±5.16	
More than one day per week	52.36±6.12	0.83
Once weekly	53.33±5.12	
Once monthly	52.21±6.11	
Never	52.75±5.61	
Using regular sunscreen		
Yes	52.68±5.60	0.94
No	52.72±5.67	
Frequency of sun exposure		
Daily	54.27±5.51	
2-3 times per week	52.09±4.46	<0.001*
4-6 times per week	53.00±7.32	
Once per week	51.00±4.95	
Once per month	50.25±7.29	
No exposure	49.08±7.68	
Usual time of sun exposure		
10am-12pm	51.39±5.97	
12pm-4pm	54.23±4.78	<0.001*
After 4 pm	51.15±5.69	
No exposure	49.08±7.68	

*: Statistically significant at p < 0.05 SD Standard Deviation

Table 4: Results of multiple linear regression analysis of significant variables related to skin aging among sample of community-dwelling adults over forty-five in Alexandria, Egypt (n=360)

	B	SE	T	p-value	95% CI	
					LL	UL
Age (years)	0.16	0.03	4.90	<0.001*	0.10	0.23
Marital status						
Married (Ref.)						
Widowed	2.00	0.78	2.56	0.01*	0.46	3.54
Divorced	-0.37	0.88	-0.41	0.67	-2.10	1.36
Single	-1.68	1.30	-1.29	0.19	-4.24	0.87
Duration of sleep						
<6 hours	2.35	1.04	2.25	0.02*	0.29	4.40
6-8 hours	1.39	0.98	1.40	0.16	-0.55	3.33
>8 hours (Ref.)						
Daily sugar spoons						
One/day (Ref.)						
More than one/day	1.42	0.55	2.58	0.01*	0.34	2.51
Daily water intake						
less than 8 cups/day	2.81	0.99	2.83	<0.001*	0.86	4.75
More than 8 cups/day (Ref.)						
Smoking						
Non-smokers (Ref.)						
X-smoker	-0.83	1.42	-0.58	0.55	-3.64	1.96
Current smokers	3.59	0.72	5.00	<0.001*	2.18	5.01
Sun Exposure**						
infrequent sun exposure (Ref.)						
Frequent sun exposure	2.00	0.70	2.83	<0.001*	0.61	3.39
Low risk exposure (Ref.)						
High risk exposure (12pm-4pm)	1.82	0.54	3.32	<0.001*	0.74	2.89
R^2= 0.58, F= 8.49, p<0.001*						

**Frequent sun exposure=daily, 2-3 times per week and 4-6 times per week, infrequent sun exposure=once weekly, once monthly and no exposure B: Unstandardized Coefficients SE: Standard error *: Statistically significant at p < 0.05 CI: Confidence interval LL: Lower limit UL: Upper Limit

DISCUSSION

Skin aging signs are variable, and many scales are used to assess them. However, there is no standardized scale, making it challenging to compare findings across different scales. In the present study, most participants had pigmented spots on the cheeks and forehead and pronounced furrows between the

eyebrows, while the majority did not have black or white comedones on the cheeks or forehead. These findings are consistent with a study conducted in France, where most individuals also had pigmented spots, marked furrows between the eyebrows, and no comedones [4]. In a recent systematic review including fifty-one studies which linked their study outcomes to skin aging, the most frequent reported skin aging signs were hyperpigmentation, wrinkling and skin sagging [10]. These results are nearly similar to the current study. This study also revealed that an increase in the SAS was significantly associated with increasing age. This was in accordance with another study conducted in France [11] as they found a linear relationship between the SAS and chronological age.

In the present study healthy nutritional habits as increased consumption of fruits and vegetables and decreased consumption of sugar, carbohydrates and trans-fat were associated with lower SAS; thus, less skin aging signs. This was in accordance with studies conducted in France and in the Netherlands [12-14]. Fruits and vegetables are rich in antioxidants, vitamins, and minerals that help protect the skin from oxidative stress and inflammation, which are known to accelerate skin aging. Conversely, high consumption of sugar, carbohydrates, and trans fats can contribute to increased oxidative stress and inflammation. Thus, adopting a diet rich in fruits and vegetables while limiting sugar, carbohydrates, and trans fats helps mitigate these damaging processes, leading to healthier skin and a lower SAS [13].

The cutaneous water content is well known for its importance in preserving the skin barrier, preventing skin aging and preventing several dermatological dysfunctions. Thus, drinking the appropriate amount of water is essential for the skin. In the current study, it was found that higher water intake was associated with lower SAS thus less skin aging signs. Similarly, this was found in another study conducted by Palma et al; in which higher water intake (2 liters or more daily for 1 month) was associated with improvement in the normal skin physiology and in the skin aging signs [15].

The present study revealed that current smokers exhibited the highest SAS, indicating more pronounced signs of skin aging. Similar findings have been reported in studies conducted in France, the USA, Japan, Australia, Canada, and the UK [11, 16-18]. Additionally, the study found that sleep quantity negatively affected SAS, with individuals who slept less displaying significantly higher SAS. This aligns with a study conducted in the USA, which found that those who slept less had higher skin aging scores and more visible signs of aging [19]. Also, this was in accordance with another study conducted in Sweden [20]. Interestingly, research by Gupta et al. in 2015 demonstrated that individuals with severe insomnia exhibited more signs of skin aging and lower satisfaction with their cutaneous body image (CBI); the fewer the hours of sleep, the more significant the skin aging signs and the lower the CBI satisfaction [21].

Photoaging is well known to be responsible for most skin aging signs [22]. In accordance with this, the present study revealed that daily sun exposure was associated with higher SAS and more skin aging signs. This was in accordance with a study conducted in France; in which they compared females seeking sun exposure regularly and other sun-phobic females. It was found that those who were exposed to the sun regularly had more skin aging signs especially pigmentations [23]. Also, other studies conducted in China, Japan and Hong Kong found that more sun exposure results in more skin aging signs similar to our study [24-26].

Study limitations

One limitation of the study is the potential lack of representativeness in the sample. Since the participants were recruited from clubs, which generally cater to individuals from higher socioeconomic backgrounds, the sample may not fully reflect the broader population. To address this limitation and enhance community representation, syndicate clubs were included alongside social clubs in the recruitment process. Another limitation concerns the study design. Due to its cross-sectional nature, it is not possible to establish a temporal association between exposure and outcome. Additionally, the use of an interview questionnaire to collect data may have introduced information and recall biases. These biases could affect the accuracy of the responses.

CONCLUSION AND RECOMMENDATIONS

The study revealed a significant association between skin aging signs and various factors such as age, nutritional habits, smoking, sleep patterns, sun exposure, and water intake. Notably, an increase in the SAS was observed with advancing age, highlighting the natural progression of skin aging. Additionally, unhealthy lifestyle factors such as smoking, poor sleep habits, and excessive sun exposure were linked to higher SAS and more pronounced skin aging signs. Conversely, healthy dietary habits, including increased fruit and vegetable consumption and adequate water intake, were associated with lower SAS and fewer skin aging signs. These findings highlight the importance of lifestyle modifications in mitigating skin aging effects.

Based on the study findings, several recommendations emerge to promote skin health and delay the onset of skin aging signs. Advocating for healthy dietary habits is essential, emphasizing increased consumption of fruits, vegetables, and water while reducing sugar, carbohydrates, and trans-fat intake. Smoking cessation programs should be

implemented, along with raising awareness about the detrimental effects of smoking on skin aging. Sun protection is important, with encouragement for the use of sunscreen and protective clothing to minimize sun exposure and prevent photoaging. Public awareness campaigns should be intensified to educate individuals about the factors contributing to skin aging and the significance of adopting healthy lifestyle habits to maintain skin health and youthfulness.

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CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

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