Skin autofluorescence is associated with the metabolic syndrome and its individual components

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Introduction

Advanced glycation end products (AGEs) accumulate in tissues as a result of aging. The accumulation of AGEs is increased in subjects with diabetes and impaired renal function. AGE accumulation in the skin can be measured non-invasively by skin autofluorescence (SAF) with a device known as the AGE Reader.

Individuals with the Metabolic Syndrome (MetS) are at increased risk for type 2 diabetes and several cardiovascular diseases. Therefore, it would be of great interest whether SAF is associated with MetS and its individual components. This may be of major importance when using SAF as a screening tool in populations at high risk for cardiovascular diseases and type 2 diabetes.

Objective

In the present study, we assessed the association between SAF and MetS and its individual components. We investigated whether SAF levels increase with a higher number of MetS components. In addition, we examined whether the presence of MetS can be predicted by SAF.

Methods

Participants

We used large population-based data of non-diabetic participants from the LifeLines Cohort Study. Subjects with impaired renal function, defined as a serum creatinine >140 mmol/L, were excluded from the study. This resulted in 78,654 subjects eligible for analysis. MetS was defined according to the revised NCEP ATP III.

Skin autofluorescence

SAF was measured non-invasively in all participants using the AGE Reader (Diagnoptics Technologies, Groningen, The Netherlands) [1].

Statistical analyses

Subjects were categorized in 3 groups according to their BMI (normal weight <25 kg/m^2, overweight 25-30 kg/m^2 and obese >30 kg/m^2) and their age-adjusted SAF Z-scores (tertiles; low, middle, high). Logistic regression analyses was performed in order to assess the presence of having MetS using SAF. In the adjusted models, we corrected for determinants of SAF reported in our previous study (age, BMI, HbA1c, eGFR, current smoking, pack-years and coffee consumption) [2]. SPSS (version 22, IBM, Armonk, NY, USA) was used for statistical analysis.

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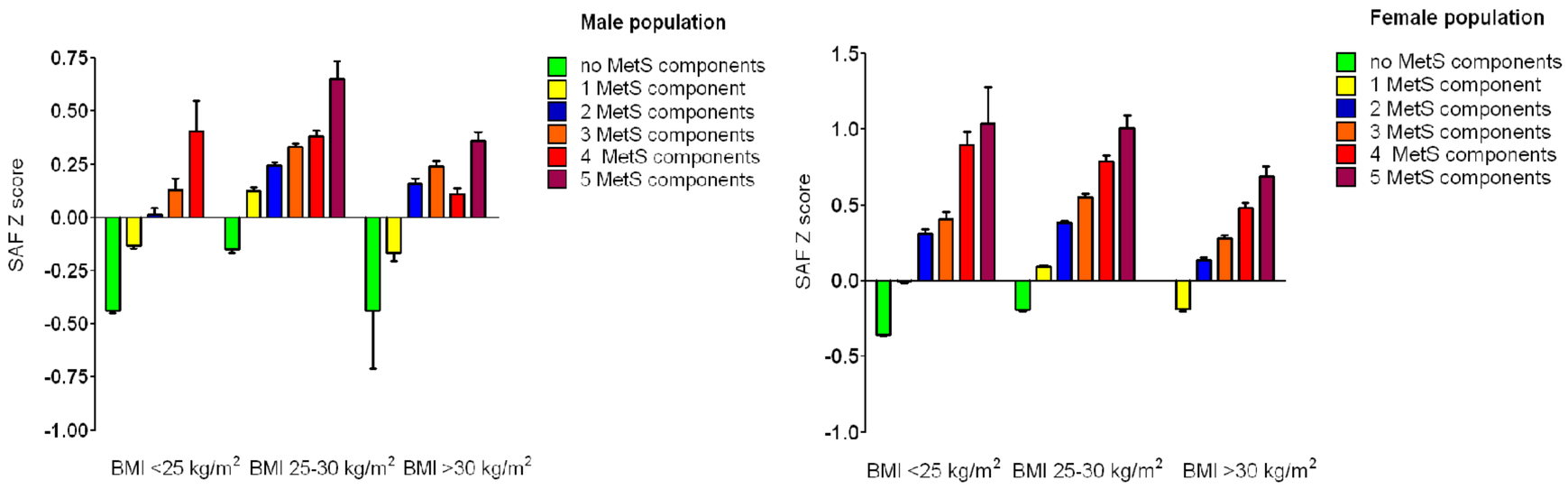
Table 1. Clinical characteristics of the total population

Clinical characteristics	Men (32 558)		Women (46 006)	
	MetS	No MetS	MetS	No MetS
N (%)	6 205 (19%)	26 353 (81%)	5 345 (12%)	40 661 (88%)
Age (years)	**49 ± 11**	44 ± 13	**50 ± 12**	44 ± 12
BMI (kg/m²)	**29.8 ± 3.6**	25.5 ± 3.1	**30.6 ± 5.1**	25.1 ± 4.1
Waist circumference (cm)	**106 ± 9**	93 ± 9	**100 ± 11**	85 ± 11
SBP (mmHg)	**141 ± 14**	129 ± 14	**138 ± 16**	121 ± 15
DBP (mmHg)	**82 ± 9**	76 ± 9	**79 ± 9**	72 ± 9
HDL-C (mmol/l)	**1.04 ± 0.23**	1.37 ± 0.30	**1.24 ± 0.30**	1.65 ± 0.38
Triglycerides (mmol/l)	**2.03 (1.60-2.73)**	1.04 (0.77-1.40)	**1.72 (1.18-2.14)**	0.83 (0.64-1.11)
cGFR (ml/min)	**137 ± 36**	124 ± 28	**125 ± 39**	111 ± 29
Glucose (mmol/l)	**5.45 ± 0.55**	4.98 ± 0.93	**5.33 ± 0.61**	4.75 ± 0.42
HbA1c (%)	**5.7 ± 0.3**	5.5 ± 0.3	**5.7 ± 0.4**	5.5 ± 0.3
Current smokers (%)	**27%**	21%	**23%**	19%
Former smokers (%)	**39%**	32%	**36%**	32%
Coffee consumption	**4.7 (2.8-5.6)**	3.7 (2.8-5.6)	**3.3 (1.9-4.7)**	2.8 (1.3-4.7)
SAF (AU)	**2.07 ± 0.44**	1.94 ± 0.43	**2.07 ± 0.45**	1.86 ± 0.42
SAF Z score (age-adjusted)	**0.28 ± 0.91**	-0.07 ± 1.00	**0.49 ± 0.98**	-0.06 ± 0.98

Table 2. The association between SAF and the presence of metabolic syndrome assessed by logistic regression analysis (total population)

SAF group	MetS / Total population	Model 1	Model 2	Model 3
Low SAF	2 419 / 28 271	Reference	Reference	Reference
Middle SAF	3 417 / 22 386	1.925 (1.821-2.035)	1.702 (1.600-1.811)	1.509 (1.376-1.655)
High SAF	5 751 / 28 014	2.761 (2.624-2.904)	2.583 (2.441-2.734)	2.040 (1.845-2.257)
P value		**<0.0001**	**<0.0001**	**<0.0001**

Figure 1. Age-adjusted SAF Z scores increase with a higher number of MetS components (total population)



Major Findings and Conclusions

We have demonstrated that SAF is elevated in subjects with MetS. In addition, both in men and women and independently of BMI, SAF Z-scores increased with a higher number of individual MetS components. Furthermore, we have shown that SAF is significantly and independently is associated with the presence of MetS.

When taking these and previous observations on SAF with different clinically relevant phenotypes into account, the AGE Reader could be potentially used as an (additional) screening tool to identify individuals at high risk for developing metabolic and cardiovascular complications.

References

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2. van Waateringe RP, Slagter SN, Wolffenbuttel BH et. al. Lifestyle and clinical determinants of skin autofluorescence in a population-based cohort study. Eur J Clin Invest. 2016; 46(5):481-90.

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