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Short Communication

A COMPARISON OF THE TOTAL ANTIOXIDANT CAPACITY OF SOME HUMAN BODY FLUIDS

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Abstract: The Total Antioxidant Capacity of several human fluids was compared and the following sequence of TAC values was found: urine > saliva > blood plasma > milk \approx amniotic fluid \gg sweat. Lower TAC values were found for the saliva of smokers than for that of non-smokers. Drinking of a cup of instant coffee increased the hydrogen peroxide content of urine but did not decrease the TAC of urine.

Key Words: Total Antioxidant Capacity, Antioxidants, Blood Serum, Sweat, Milk, Amniotic Fluid, Urine, Saliva, Hydrogen Peroxide

INTRODUCTION

Total Antioxidant Capacity (TAC) is a parameter characterizing the sum of the activities of antioxidants present in the material studied. TAC, most frequently studied in blood serum, may be a marker of the antioxidant status of the body, and may reflect the level of supplementation with antioxidant vitamins and oxidative stress imposed on the organism [1-3]. Other body fluids are analyzed less frequently for TAC. It seemed interesting to compare the TAC of some easily available human body fluids and compare it with that of blood plasma.

MATERIALS AND METHODS

2,2'-Azobis(2-amidopropane) (AAPH) was obtained from Polysciences (Warrington, PA). All the other reagents were from POCH (Gliwice) and were of analytical grade. Crocin was extracted from saffron according to Bors *et al.*

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[4]. Blood and other body fluids were obtained from healthy volunteers. Blood was anticoagulated with citrate. Human milk was centrifuged (15 min, 15 000 x g) and the clear supernatant was used for measurements. Unstimulated (resting) saliva was obtained in the morning and no oral stimulus was permitted 60 min prior to collection.

TAC was estimated by assessing the inhibition of AAPH-induced crocin bleaching [5]. Hydrogen peroxide in urine was measured via the horseradish-peroxidase catalysed oxidation of Phenol Red [6]. Creatinine level/content/amount was estimated using the method of Jaffe [7].

RESULTS AND DISCUSSION

The Total Antioxidant Capacity of blood plasma was found to depend on the age of the donors, with older donors showing lower TAC values (Tab. 1). This dependence is rather striking taking into account reports on the lack of an age dependence of blood plasma TAC until the age of 74 [8]. On the other hand, several authors reported a negative correlation between age and plasma TAC [9-11]. Moreover, antioxidant supplementation may be expected to correlate negatively with age in the relatively poor, and in study regions where a traditional cuisine which is not abundant in fruit and fresh vegetables is more popular among older persons.

Tab. 1. The TAC of the blood serum of healthy volunteers of various age groups

Age group (years)	18-24	25-39	40-60
N	31	31	31
TAC [mM]	0.84 ± 0.34	0.59 ± 0.18	0.49 ± 0.20

Urine was found to have a much higher TAC than blood plasma, which is understandable taking into account the high content of uric acid. This antioxidant is a major contributor to the TAC of blood plasma [3, 5, 12, 13], and it dominates the TAC of urine, being present at higher concentrations in urine than in plasma [14, 15]. The higher TAC of urine with respect to that of blood plasma has been reported by other authors [14-17]

The TAC values of saliva were also found to be higher than those of blood plasma. The saliva of smokers (4 to over 20 cigarettes per day) was characterized by a much lower TAC than that of non-smokers. This result contrasts with the data of other authors, who did not find such differences [18, 19]. One of the reasons for the differences found in this study may lie in the consumption of strong cigarettes of high tar values by a significant fraction of the smokers studied.

Milk and amniotic fluid had lower TAC than blood. Interestingly, The TAC of milk was reported to be higher than that of blood plasma, especially in some ethnic groups of Nigerian women [20]; the present data indicate that this may be

not a general rule. Extremely low TAC values were found for human sweat (Tab. 2).

Tab. 2. The TAC of some human body fluids

Fluid	Age of donors (y)	N	TAC [mM]
Urine	23-25	16	7.42 ± 3.90
Saliva (non-smokers)	18-28	31	2.03 ± 2.32
Saliva (smokers)	23-64	20	0.76 ± 0.88
Amniotic fluid	19-26	17	0.29 ± 0.17
Milk	20-41	14	0.29 ± 0.16
Sweat	23-27	7	0.036 ± 0.018

Coffee drinking has been reported to significantly increase the hydrogen peroxide content of urine [21, 22]. It seemed therefore of interest to check whether coffee ingestion affects the TAC of urine. Eight healthy volunteers drank one 200-ml cup of instant coffee (Nescafe; 1 g/100 ml); urine was collected before the drink and about 60 min later. Although we found much lower levels of hydrogen peroxide in the urine than previous authors, our results confirm the increase in the hydrogen peroxide concentration in urine after coffee ingestion. The increase in hydrogen peroxide content of urine was, however, not associated with any decrease in the TAC of urine, either expressed per volume of urine or per creatinine content (Tab. 3). However, such a result is not surprising taking into account that uric acid, a poor reactant with respect to hydrogen peroxide, is the major determinant of the TAC of urine [14, 15].

Tab. 3. The effect of coffee ingestion on the level of hydrogen peroxide and TAC of urine (n=8).

Parameter	Hydrogen peroxide		TAC	
	µmol/l urine	nmol/mol of creatinine	mmol/l urine	µmol/mol of creatinine
Before coffee	0.28 ± 0.13	33.5 ± 18.6	3.64 ± 1.03	436 ± 176
After coffee	0.48 ± 0.16*	66.0 ± 28.3*	3.69 ± 1.06	490 ± 206

*P < 0.05 (Student's "t" test)

Undoubtedly, the estimation of the TAC level of body fluids other than blood plasma, especially of those available non-invasively, may provide additional information concerning the antioxidant status of the body.

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