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Hair Mineral Content in Relation to Colour and Sex of Egyptian Badawy Goats

R. S. Farag,* S. T. El-Aassar and E. A. Abdel Rahim***

Biochemistry Department, Faculty of Agriculture, Cairo University, and Biochemistry Department, Faculty of Medicine, Zagazig University, Egypt.*

CLEANED and dried hair samples of Egyptian Badawy goats were acid digested and atomic absorption spectrophotometer is used for the determination of Na, K, Ca, Fe, Cu, Mg, Pb, Zn and Cr. The analysis showed that K and Pb hair content might be used to differentiate between males and females. The relation between hair colour and its metallic elements revealed that Mg of black and brown hairs was occurred on higher concentrations with respect to white hair.

Several attempts have been conducted during the past few years to asses the trace mineral status of cattle by measuring mineral level in the hair as reported by Hidiroglou *et al.* (1965) and Binot *et al.* (1968). Whereas, little research has been carried out to find the correlation between the exposure effect of the subject to heavy metals and mineral content of hair. This field of research attracted some investigators, for instance, Cotzias *et al.* (1964) used hair levels of Pb and As in clincal poisoning.

The purpose of this study was to determine the mineral content of the Egyptian Badawy goat's hair since no reports have been published in this respect. Also, the study was devoted to include hair mineral content in relation to sex and coulr of the hair.

Material and Methods

Hair samples

Black, brown and white hairs were selected from the Egyptian Badawy goats. Hair samples were collected from both sexes with ages ranged from one to three years old according to Miller's (1959) classification and maintained at a constant diet composition for at least eight weeks before the beginning of collection at winter. The hair was trimmed to approximately 0.2 cm above the body surface from the ventrum of abdomen and kept in a polythene bottle until use.

Purity of reagents

Deionized water of high quality was used for the preparation of all aqueous solutions. All the polythene bottles used for hair collection and glassware used for hair analysis were firstly cleaned with soap, rinsed with water then soaked in 0.5% solution of the disodium salt of ethylene diamine tetraacetic acid (EDTA) for at least 24 hr before use. Finally they were washed six times with deionized water in order to remove the chelated metals and excess EDTA.

Solvents used throughout this investigation were analytical grade and redistilled before use. EDTA was added to solvents to be in the concentration of 0.05% in order to chelate any race elements might be present in it. The metal salts used for the preparationn of standard stock solutions were BDH grade and recrystalized before use.

Apparatus

Analysis was performed using a Pye Unicam model SP 1900 atomic absorption spectrophotometer equipped with a boiling air-acetylene and nitrous oxide-acetylene burner and recorder readout. All determinations were carried out with air-acetylene gas mixture except for chromium. Hollow cathode current, slite sitting and wavelength were set for each element as suggested by the manufacturer. Both acetylene and air flows were maintained throughout the experiments at 1:5 l/min. Whilst, the nitrous oxide and acetylene flows were 4 5 and 5 5 l/min, respectively.

Preparatiou of hair samples for chemical analysis

Hair samples were washed successively three times each with deionized water, acetone, ether, acetone and deionized water to remove dirt and foreign materials adhering to the hair as mentioned by Petering *et al.* (1971). The hair samples were then dried for 24 hr at 100°.

Digestion of hair samples

Hair analysis was made on a known weight of the washed and dried hair samples and wet digestion procedure was performed according to the method of Linder (1944).

Preparation of standard stock solution

Standard stock solutions of 1000 ppm for the elements : Na,K, Ca, Cu, Mg, Mn, Fe, Zn, Pb and Cr were prepared from their metals or metal salts using deionized water and stored in a polythene bottles.

Mineral determination

A series of 5-10 working standard solutions with different concentrations were daily prepared from the stock solutions (1000 ppm). The hair sample solution (0.5%) was used as it is. Three determinations were made for each element in a pattern : standard-sample-standard-sample-standard-sample. After each determination of either sample or standard, deionized water was aspirated through the 0.015 inch tube of the burner atomizer to verify a return of the absorbance reading to about 0%.

Mean absorbance for samples and standars from the three determinations and graphic plot of absorbance of the standard solutions over the working ranges of concentrations were linear for all elements. The quantity of each element was read from the corresponding standard curve.

Statistical analysis

The variables influence of the colour and sex on the content of metals in the hair was evaluated by applying T-test according to Snedecor (1956).

Results and Discussion

The determination of hair mineral content is quite helpful which can be used for sex determination, in cases of poisoning and criminal comparison for identification or eliminate suspect. In this work, extreme care has been taken to avoid hair contamination by extraneous metals which may cause erroneous interpretation. Atomic absorption spectrophotometer was utilized in this study for determining Na, K, Cu, Mg, Mn, Fe, Zn, Pb and Cr owing to its high sensitivity and precision.

Tables 1 and 2 show the mineral range and mean content for males and females in black, brown and white hairs of Egyptian Badawy goats breed. The mean values of Na content in black, brown and white Badawy goat's hair were 173 ± 5, 191 ± 8.2, 165 ± 7.9, 159 ± 4.7 and 189 ± 5.6, 173 ± 13.2 mg/100 g dry hair for males and females, respectively. These results showed clearly that no significant sex variation for Na content ($P < 0.05$). Generally speaking, males of brown and white hairs contained higher Na content than females, whilst in the case of black hair of females contained higher Na content males. In this respect, Coleman *et al.* (1966) found significant difference for males and females Na hair content.

There was a highly significant ($P < 0.001$) variation between males and females of the three coloured Badawy goats in K hair mean content which were 76 ± 2.6, 52 ± 2.8, 68 ± 6.5, 43 ± 0.7 and 72 ± 3.8, 47 ± 3.3, respectively. One might deduce that males contained more K than females. This sex specific finding might be considered of value as a medicolegal sign in identification and differentiation betwen males and females.

Concerning the Ca content of Badawy goats, the mean values were 180 ± 4.9, 123 ± 10.6 mg/100 g dry hair for males and females, respectively which displayed highly significant sex variation ($P < 0.001$). On the other hand, black or brown exhibited no significant sex correlation in Ca content ($P < 0.05$). In this respect, Coleman *et al.* (1966) and Petrosyan and Tumanov (1974) found sex different values for Ca in hairs.

In dealing with Cu hair content of both sexes, the mean values found to be 9 ± 0.3, 3 ± 0.1, 5 ± 0.8, 9 ± 1.2, and 12 ± 0.7, 5 ± 0.6 mg/100g hair for males and females of black, brown and white hairs, respectively. These results showed highly signifcant ($P < 0.001$) sex variation with respect to Cu hair content.

TABLE 1. Range of hair mineral content in common colours of Egyptian Badawy goats.

Element	Black		Brown		White	
	Male,mg%	Female,mg %	Male,mg%	Female.mg %	Male.mg%	Female,mg%
Na	142-203	156-222	149-177	152-176	158-219	125-207
K	60-93	45-71	60-81	42-45	56-89	38-52
Ca	244-368	257-336	170-201	170-199	155-197	103-161
Cu	6-11	4-7	4-6	6-14	8-16	3-6
Mg	130-220	190-270	200-220	110-210	110-190	110-130
Mn	24-41	45-57	53-56	26-40	28-38	21-35
Fe	164-245	221-357	342-383	206-288	187-286	195-265
Zn	14-25	15-26	17-20	15-24	16-27	19-22
Pb	20-31	11-19	33-41	18-30	22-45	9-19
Cr	00-00	00-00	00-00	00-00	00-00	00-00

TABLE 2. Mineral mean content of both sexes in common colours of Egyptian Badawy goats.

Element	Black		Brown		White	
	Male,mg%	Female,mg %	Male,mg%	Female,mg %	Male,mg%	Female,mg%
Na	173±5	191±8.2	165±7.9	160±4.7	199±5.6	173±13.2
K	76±2.6	52±2.8	68±6.5	43±0.7	71±3.8	47±3.3
Ca	309±10.1	304±7	188±9.5	184±4.2	180±4.9	123±10
Cu	9±0.3	5±0.1	5±0.8	5±1.2	12±0.7	5±0.6
Mg	164±7.8	216±8.2	211±5.8	167±16.8	134±7.9	123±3.7
Mn	32±1.3	53±1.6	61±4.8	32±1.9	32±0.9	27±2.4
Fe	204±6.1	305±13.7	362±11.7	225±12.8	257±8.9	236±12.3
Zn	18±0.8	20±1.1	19±1.3	18±1.4	22±1.1	12±1.8
Pb	25±2.5	14±0.9	37±4.2	22±1.8	33±2.2	14±1.6
Cr	00	00	00	00	00	00

± refers to standard error.

The mean values of Mg content in Badawy goat's hair for males and females showed no significant sex variation $P<0.05$), but in case of black hair, there was highly signifcant ($P<0.01$) sex variation with respect to its Mg content. The mean values for black and brown hairs contained more Mg than of white hair. These findings agreed with Van Koetsveld (1958) who mentioned that in general, colured hair contained more trace elements than white hair.

In respect of Mn hair content black and brown Badawy goats displayed a highly signifcant sex variation ($P<0.001$) whilst, there was no significant correlation ($P<0.05$) between male and famale goats of white hairs. Our results partly in line with Eads and Lambdin (1973) since they showed that Mn content was approximately the same in both males and females. Hence, no specific variation might be used with Mn hair content between males and females.

In dealing with Fe hair content there was sex significant correlation ($P<0.001$) for black and brown hairs since the mean values were 204 ± 6.1, 305 ± 13.7 and 362 ± 11.7, 225 ± 12.8 mg/100 g dry hair for males and females, respectively. No significant sex variation ($P<0.05$) between males and females white hairs, respectively. Therefore, no definite correlation between hair colour and Fe content. This conclusion is in accordance with the results of Besson and Brecej (1961). The mean values for Zn content in black, brown and white hairs were 18 ± 4.8, 20 ± 1.1, 19 ± 1.3, 18 ± 1.4 and 22 ± 1.1, 21 ± 1.18 mg/100 g dry hair for males and females, respectively (Fig. 8). In other words, Zn content was approximately the same in both males and females. Hence, no sex specific change ($P<0.05$) might be used with Zn hair content between males and females. These findings conicide with the results of Morita (1960) since he reported no relation with colour of hair and its Zn content.

In regard to Pb content of hair samples under investigation the results revealed that significant sex variation ($P<0.01$) for the brown hair samples and highly significant ($P<0.001$) for both black and white hair samples. The mean values for Pb content in black, brown and white hairs of both sexes were 25 ± 2.5, 14 ± 0.9, 37 ± 4.2, 22 ± 1.8 and 33 ± 2.2, 14 ± 1.6 mg/100 g dry hair for males and females, respectively. Generally speaking, males of the three coloured hairs contained higher Pb content than females. Our results were in accordance with the results of Eads and Lambdin (1973).

Several experiments were conducted in order to determine Cr in hair samples using very high concentrations of digested hair. Nevertheless, the authors could not be able to detect Cr metal in spite of the very high sensitivity and precision of the atomic absorption spectrophotometer.

The results of this investigation demonstrated that K and Pb hair mineral content might be used as sex specific and as a value in medicolegal sign, while no difference was observed between male and female Na, Ca, Cu, Mg, Mn, Fe, Zn and Cr hair content. The relation between hair colour and its metalic elements showed Mg of black and brown hair samples was occurred in higher concentrations with respect to white hair.

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دراسة كيماوية على بعض العناصر المكونة لشعر الماعز صنف البدوى ذو الوان مختلفة واستخدامها للتميز ما بين الذكور والأناث

رضوان صدقى فرج ، شاكر طلخان الأعسر و امام عبد الرحيم

كليات الزراعة ، جامعتى القاهرة والزقازيق

قدرت نسبة عشرةعناصر وهى الصوديوم ـ البوتاسيوم ـ الكالسيوم ـ الحديد ـ النحاس ـ المغنسيوم ـ المنجنيز ـ الرصاص ـ الزنك ـ الكروميوم فى شعر الماعز صنف البدوى ذو اللون الأبيض والأسود والبنى • واستخدام فى هذه الدراسة جهاز الامتصاص الذرى لتقدير العناصر بعد تخلص الشعر تماما من الشوائب وبصفة خاصة العناصر التى من مصدر خارجى • وقد أظهر التحليل الاحصائى للنتائج على مايلى :

١ ـ تستخدم نسب عنصرى البوتاسيوم والرصاص للتفرقة ما بين شعر الذكور والاناث •

٢ ـ يحتوى الشعر الملون (أسود وبنى) على نسب أعلى من المغنسيوم بالمقارنة بالشعر الأبيض •

٣ ـ لايحتوى شعر الماعز صنف البدوى على عنصر الكروم على العكس من أصناف الماعز الأخرى المنتشرة فى انحاء العالم وبهذه النتيجة يمكن التفرقة ما بين شعر الماعز صنف البدوى المصرى والماعز الأجنبى •