

Biochemical Parameters of some Metals in Coloured Egyptian Male and Female Balady Goat's Hair

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A STUDY was conducted to determine some metals in Egyptian Balady goat's hair as a function of colour and sex. Extreme care was taken to insure that hair samples were metal-free from any extraneous metal contaminants. The hair samples were analysed using atomic absorption spectrophotometer for : Na, K, Ca, Mg, Mn, Fe, Cu, Zn, Pb and Cr. The values for hair Na, K, Ca, Mn and Zn for males were higher than that for females. Whilst, Pb hair content for females was higher than that for males. These results gave an obvious evidence to distinguish between males and females. Also, Zn and Ca levels could be taken as a criteria to recognize the colour of hair.

Considerable interest has been given in recent years to the use of hair as an index to the status of essential trace metal metabolism in the body and also in the field of air pollution. Such analysis became especially significant when the subject exposed to high amounts of toxic metals. For instance, Cotzias *et al.* (1964) found that hair levels of Pb and As would give an indication of poisoning in hair. No reports have been published in Egypt on the metal content of Egyptian Balady goat's hair. Therefore, this report is the first to show up the distribution of some metals of goat's hair in Egypt. This investigation was extended, indicate the relation between hair metal content with regard to sex and common colours of Egyptian Balady goat's hair.

Material and Methods

Materials

Thirty hair samples were collected from each of the three common colours of Egyptian Balady goat's (black, brown and white). Individual goats in both sexes have been chosen with ages ranged from one old to three years old according

to Miller (1959) classification and kept at a constant diet composition for at least eight weeks before the beginning of collection at winter time. Gasterated males and pregnant or recently laboured females were avoided in this investigation. Hair samples were collected from the neck by cutting the hair above the body surface with a clean chromium plated scissors. Samples from each goat were kept separately in a polythene bottle until analysis.

Purity of reagents

Deionized water of high quality was used for the preparation of all aqueous solutions. All the polythene bottles and glassware which used for hair collection and the analysis respectively were firstly cleaned with soap, rinsed with distilled 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 several times with deionized water 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 trace elements might be present in it. The metal salts used for the preparation of standard stock solutions were BDH grade and recrystallized before use.

Apparatus

Analysis was performed using a Pye Unicam Model Sp 1900 atomic absorption spectrophotometer equipped with a boilingair- acetylene and nitrous oxide-acetylene burners and recorder readout. Hollow cathode current, slit sittings and wavelengths were set for each element as suggested by the manufacturer.

Experimental

1. Preparation on hair samples for chemical analysis

Hair samples were washed successively three times with deionized water, ether, acetone and deionized water in order to remove any extraneous metals as mentioned by Petering *et al.* (1971). After each wash the liquid was decanted and discarded.

2. Digestion of hair samples

A known weight (ca 0.5g) of the washed and dried hair samples and wet digestion procedure was performed according to the method of Linder (1944).

3. Preparation of standard stock solution

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

4. Metal determination

A series of 5-10 working standard solutions with different concentrations were daily prepared from the stock solutions (1000 ppm). Three determinations were made for each element in the following 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 was calculated for samples and standards from the three determinations and graphic plot of absorbance of the standard solutions over the working ranges of concentrations were liner for all elements. The quantity of each element was read from the corresponding standard curve.

5. Statistical analysis

Differences due to sex and colour were evaluated by using a nested model for the analysis of variance (Snedecor, 1956) as follows:

$$y_{ijk} = \mu + c_i + s_{ji} + e_{ijk}$$

where: Y_{ijk} is the observed value of the k th individual of the j th sex (s) of the i th colour (c) as the peculiar error term for the K th individual.

Results and Discussion

Identification of mammalian hair has played an important role in medicolegal practice during the past half century. The progress of medicolegal investigation demands a critical and complete study of human and animal hairs. Analyses of trace metals are very useful tool as diagnostic aids in a number of clinical conditions. Tables 1 and 2 show the mean values of major and minor metals content for males and females of common colours in Balady goat's hair respectively.

Sodium (Na)

A highly significant difference ($P < 0.01$) was observed between mean values of Na content in black, white and brown Balady goat's hair due to sex. On the contrary, colour had no effect on the variation of Na in the three coloured groups. In general, males hair in the coloured groups contained higher Na than females hair. This finding was in accordance with the results of Coleman *et al.* (1966) in which they found a significant difference of Na content between males and females hair. The sodium concentration was the highest in white hair followed by black and the brown had the lowest concentration.

Potassium (K)

There were no significant difference ($P < 0.05$) due to colour in the content of K in males and females hair. A highly significant correlation ($P < 0.01$) between sex and hair content was observed. The males hair of the coloured groups

contained more K than female hair. The sex specificity may be considered of real value as a medicolegal parameter in identification and differentiation between males and females.

Calcium (Ca)

The results of Ca hair content of Balady goat's breed showed that the colour of hair had highly significant effect ($P < 0.01$) on its Ca content. The observed correlation coefficient between sex and hair Ca content was highly significant. In this respect, Coleman *et al.* (1966) and Petrosyan and Tumanov (1974) found that sex had different values of Ca hair content, which agreed with the results obtained in this investigation.

Iron (Fe)

Statistical analysis showed a non-significant correlation between sex and Fe hair ($P < 0.05$) content. This finding was not in accordance with the results of Petrosyan and Tumanov (1974). Results obtained in the present report gave highly significant relationship between colour and Fe hair content. These results were not in line with Besson and Brecej (1961) findings, who concluded that no definite correlation between hair colour and Fe content could be obtained.

Magnesium (Mg)

Magnesium content in Balady goat's hair showed no significant sex effect ($P < 0.05$). On the other hand, the results obtained by Petrosyan and Tumanov (1974) and Coleman *et al.* (1966) showed sex difference in Mg content of hairs. The results of the present investigation exhibited no significant correlation between colour and Mg hair content.

Copper (Cu)

The hair Cu content for both sexes of normal Balady goats indicated no sex difference at probability ($P < 0.05$) for hair samples. Also, no significant ($P < 0.05$) correlation between hair Cu content and colour was observed.

Manganese (Mn)

The Mn content in black, white and brown Balady hair for males and females showed highly significant sex effect ($P < 0.01$). Survey of trace metals in human hair was carried out by Eads and Lambdin (1973), their results showed that Mn hair content was almost the same in both males and females. Statistical analysis showed that the Mn hair for goat's in the present work had no real variation due to hair colour.

Zinc (Zn)

The analysis of Zn content in black, white and brown Balady goat's hair of both sexes showed highly significant sex and colour effect ($P < 0.01$). Also,

TABLE 1. Hair minor metal content (mg/%) of Balady breed of common colours.

Colour	Sodium		Mean of colour	Potassium		Mean of colour	Calcium		Mean of colour	Magnesium		Mean of colour	Manganese		Mean of colour
	male	female		male	female		male	female		male	female		male	female	
Brown	177	106	141.5	64	33	48.5	227	174	200.5	148	113	130.5	44	27	35.5
Black	183	125	154	73	44	58.5	231	334	282.5	169	158	163.5	45	39	42
White	192	128	160	60	81	45.5	191	246	218.5	151	162	156.5	47	33	40
Mean of Sex	184	120		66	36		216	251		156	144		45	33	
L.S.D. for sex															
at 0.05															
at 0.01															
L.S.D. for colour															
at 0.05															
at 0.1															
	20.00			18.92			20.01			37.44		37.44	6.84		
	26.56			25.13			26.08			48.44		48.44	8.76		

hair Zn content in males hair was higher than that of female hair. The results suggest the use of Zn hair as an index to differentiate between males and females. A reverse results were obtained by Morita (1960) since he mentioned no relation between colour of hair and its Fe content.

Lead (Pb)

The results of Pb content of normal goat's hair revealed no significant sex difference ($P < 0.05$) for the three coloured hair samples. On the other hand, Eads and Lambdin (1973) found that males hair contained higher pb than that of females hair. These results were not in accordance with those found in the present work and those of Hidioglou and Spurr (1975). Statistical analysis showed that hair Pb levels did not vary with its colour.

Chromium (cr)

The authors did not detect Cr in the three coloured groups of both sexes in spite of the very high sensitivity of the atomic absorption spectrophotometer in detecting the presence of trace quantities of chromium.

TABLE 2. Hair major metal content (mg%) of Balady breed of common colours.

Colour	Copper		Mean of colour	Iron		Mean of colour	Zinc		Mean of colour	Lead		Mean of colour
	male	female		male	female		male	female		male	female	
Brown	6	6	6	184	126	155	19	17	18	20	29	24.5
Black	8	6	7	193	234	213.5	24	21	22.5	25	30	27.5
White	8	8	8	276	209	242.5	30	23	26.5	19	23	21

Mean of sex	7.33	6.66		218	190		24.5	20.5		21.33	27.33	
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L.S.D. for sex												
at 0.05		1.56		35.23			2.53			6.43		
at 0.01		2.07		47.61			3.36			8.18		

L.S.D. for colour												
at 0.05		1.28		27.71			2.07			6.61		
at 0.01		1.69		38.99			2.75			8.79		

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**دراسة كيميائية حيوية عن توزيع بعض المعادن في الشعر
اللون لذكور وإناث الماعز البلدى المصرى
رضوان صدقي فرج ، شاكر طلعتان الأعصر ، امام عبد الرحيم و نجيب جوهر**

هذه الدراسة هي الأولى من نوعها في مصر حيث أنه لا يوجد مثيل لها من قبل لدراسة العلاقة بين تركيز العناصر المختلفة وألوان الشعر الشائعة في شعر الماعز المصرى وكذلك أجناسه .

أخذت عينات من شعر الماعز وروعى تنظيفها من العناصر العالقة بها وقدرت العناصر التالية :

الصدوديوم - البوتاسيوم - الماغنسيوم - المنجنيز - الحديد - النحاس الزنك - الرصاص - الكروم باستخدام مطياف الامتصاص الذرى وكذلك أجرى التحليل الاحصائى للنتائج وتبين ما يلى :

أولا : تركيز عناصر الصدوديوم والبوتاسيوم والمنجنيز والزنك في شعر الذكور أعلى منها في الإناث .

ثانيا : شعر الإناث يحتوى على نسبة أكبر من عنصر الرصاص عنها في الذكور .

ثالثا : يمكن اتخاذ تركيز عنصرى الزنك والكالسيوم كمقياس للتعرف على ألوان الشعر .

رابعا : لا يحتوى شعر الماعز المصرى صنف البلدى على عنصر الكروم على عكس الأصناف المنتشرة فى العالم وبذلك يمكن التفرقة بين الماعز البلدى المصرى والأجنبى .