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Correlation Between Selected Electrolyte Concentrations in Hair and Blood

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ABSTRACT

The dermis contains hair follicles, which are responsible for producing hair. The circulatory systems contain blood, a biological fluid that gives cells oxygen and other nutrients. There are clinical situations in which blood cannot be obtained, such as when a vein collapses or a patient is in a coma. In these cases, hair analysis is required as an alternative. A quantitative experimental design, a scientific way to establish the cause-and-effect relationship among the various groups of Araoye method with fifty (50) sample size, was used to explore the link between blood and hair. After sorting the hair samples, each one was rinsed with distilled water after being cleaned twice with regular water and soap. The hair samples were put in separate crucibles and dried in an oven set at 500C for 30 minutes. After 30 minutes, the samples were removed from the oven, and each sample in the crucible received 10 milliliters of 1N sodium hydroxide (NAOH). The samples submerged into 10ml of 1N NAOH were placed back into the oven at 1000C for 1hr (the NAOH is supposed to decrease and form a paste like mixture). After centrifuging the samples in the plain container at 400 RPM, the supernatant was transferred to another plain container. In clinical practice, hair analysis can be useful for determining a patient's nutritional status and tracking the effects of treatment. The results show that there is a statistically significant ($p < 0.05$) correlation between sodium and chloride concentration and that it is significant. In contrast, there is no statistically significant correlation ($p > 0.05$) between sodium and chloride concentration.

Keyword*: blood, hair, chloride, sodium and analysis.*

INTRODUCTION

The dermis contains hair follicles, which are responsible for producing hair. One of the unique traits of mammals is their ability to generate hair. Every part of the human body is covered in follicles that generate dense terminal and fine villas hair, with the exception of regions with glabrous skin. Hair is primarily made of proteins, especially alpha-keratin, and is most commonly studied in relation to hair growth, hair types, and hair care. However, hair is also an important biomaterial [1]

Blood is a bodily fluid found in the circulatory systems of humans and other vertebrates that carries metabolic waste products away from the cells as well as vital nutrients and oxygen to the cells, The blood in the circulatory system is referred to as peripheral blood and the blood cell it carries, known as peripheral blood cells [2].

Blood-proteins, also referred to as plasma proteins, were said to be present in blood plasma. They undertake a wide range of activities, such as delivering lipids, hormones, vitamins, and minerals for immune system activation. Other blood proteins serve as enzymes, complement components, protease inhibitors, or kinin precursors. Contrary to popular belief, hemoglobin is not a blood protein because it is carried by red blood cells rather than blood serum. 55% of

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blood is composed of serum albumin [4], which also serves as a carrier for the movement of lipids and steroid hormones and is important in maintaining the oncotic pressure of plasma. 38% of blood's are made up of salt and chloride in the body, which also carry ions, hormones, and lipids that support immune system activity. The transformation of fibrinogen into insoluble fibrin, which comprises 7% of blood, is essential for blood clotting.

Normal sodium levels range from 135 to 145 milliequivalents per liter (mEq/L). Hyponatremia occurs when your blood's salt content falls below 135 mEq/L. With an atomic number of eleven and the symbol Na (from the Latin natrium), odium is a chemical element. It is a highly reactive, silvery-white, and delicate metal. Sodium is classified as an alkali metal since it is found in group 1 of the periodic chart. The sole stable isotope of it is 23Na. Since the free metal is not found in nature, it must be made from compounds. In the Earth's crust,sodium is the sixth most prevalent element and can be found in a variety of minerals, including feldspar, sodalite, and halite (NaCl) [5]. Chloride is a mineral that occurs naturally in many foods, but our primary dietary supply is sodium chloride, commonly referred to as table salt. The ion is diamagnetic and colorless. Though some chloride salts, such silver chloride, lead (II) chloride, and mercury (I) chloride, are very weakly soluble in water, it is often very soluble in aqueous solution [6]. A substance that promotes hair growth and has a vasodilatory effect is carpronium chloride (INN). Carpronium chloride. clinical information. AHFS/Medications [7]

A reliable source of consistent longitudinal metabolite data could be hair. The potential use of hair as a biospecimen for the metabolomics analysis of cervical cancer was examined in a pilot research by Ran et al. Hair, plasma, urine, and cervical tissue samples from cervical cancer and benign tumor patients were obtained. Plasma and urine samples showed no difference between the cancer and control groups, while metabolite profiles in hair and cervical tissue samples showed substantial differences. Using hair analysis, it was discovered that the majority of the changed metabolites in hair were up-regulated and that they correlated negatively with those in the cervical tissue in terms of sodium and chloride. In certain clinical situations, such as a collapsed vein or a patient in coma, blood cannot be accessed, necessitating the use of an alternative. Additionally, blood only reflects immediate changes, requiring a retrospective sample. In this study, hair will be used instead of blood [8]. An alternative is required because there are clinical situations in which blood cannot be accessible, such as when a vein collapses or a patient is in a coma. A retrospective sample is necessary since blood only reflects immediate changes, which is another disadvantage of using blood as a clinical indicator. Hair will be used in place of blood in this study. Hair is a long-term metabolic blueprint that can span several years, whereas blood and urine tests reveal the recent and present state of the body. An extended period of profound unconsciousness, coma is brought on by severe traumatic brain damage, stroke, or low oxygen levels in the brain. In critical condition of coma blood cannot be taken from the vain due the quantity of oxygen in the body[9] In a collapsed vein, a clot forms inside the vein walls as a result of the external walls of the vein becoming inflamed and enlarged. The absence of blood flow to the area is a clear indication that a vein has collapsed. Blood cannot be drawn if a trial is conducted to shoot up into a collapsed vein. Blood cannot be collected in situations where blood diseases such as bleeding disorders or blood clotting disorders have been identified [10]. When blood cannot be extracted from the vein or used in the previously specified situations, hair becomes the sole option available for clinical investigation at that point. Hair analysis is special because it is a low-cost, non-invasive method of providing direct information about cellular activity, which is the primary site of nutritional metabolism in chloride and sodium.

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MATERIAL AND METHODS

Study Area

The study was conducted at Otuoke, in Ogbia local government area, in Bayelsa state. The blood sample was taken at Federal Medical Centre Otuoke, and the biochemical investigation was carried out at Eni-Yimini Laboratory (*el)* Limited at Yenizue Gene Epie, Yenagoa Bayelsa State.

Research Design

The research design used to study this is a quantitative experimental design, which is a scientific method to establish the cause-and-effect relationship among the various groups. (Hair and Blood) that make up the study.

Population Size

A sample size was calculated using a formula proposed for studies where the population is less than 10,000 (Araoye, 2004). The formula is stated and the components defined below:
n / (1 + n / N);
Where
n = Is the total number of samples in the study (where the study took place),
N = population of sample (the surrounding area), that is (25/1+25) = 50

The first group was the hair which where process to get the filtrate and was extracted from all the groups for biochemical analysis.

The second group was the blood and it was in two categories, one was the red cap container which where centrifuge to get the serum extracted from all the groups for biochemical analysis.
There are some selected sample sizes for this study since biomarkers are numerous the list of the one for this study are (sodium and chloride). Selected cation are present as elementary compounds or mineral deposits in nature, from which they are extracted and processed for different purposes. The sample were collected from one location.

Selection Criteria

The Hair and Blood were obtained from the student in the Biochemistry Department, Faculty of Sciences, University of Otuoke, for this study. The hair and blood used were apparently healthy and active, as confirmed and approved by a veterinary doctor. Hair and blood showing signs and symptoms of illness were excluded from the research. Also excluded were samples with any form of disorder.

Ethical Approval

The ethical approval was granted by the Directorate Quality of Research Assurance, Federal University Otuoke, Bayelsa State, Department of Biochemistry, as attached in the appendix. *A trichologist* is a specialist who focuses on trichology, the study of diseases or problems related to the hair, and a hematologist is a specialist who focuses on hematology, the study of blood.

Materials/Equipment Used

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The materials or equipment's used in this research study includes accurex chemistry analyzer, 5ml syringe and needle, plain containers, test tubes, capillary tubes, monochromatic paper, refrigerator, micropipette, 301 spectrophotometers

Sample Collection

The hair and blood sample were collected from 10 students from the department of Biochemistry, Faculty of science. Also, the students were informed prior to the day of collecting the sample. The blood Samples collected into plain tubes were spun in a centrifuge and the supernatant separated for determination of sodium and chloride, the supernatant were stored in a fridge. The samples were employed for the determination of the relationship between hair and blood protein using albumin, total protein and globulin as parameters.

LABORATORY METHODS AND PROCEDURES

Hair Processing Procedures

The hair samples were sorted out, each sample was washed twice with ordinary water and detergent and then rinsed with distilled water. The hair sample were placed in different crucible and were placed inside an oven to dry for 30mins at50^0C. The samples were brought out from the oven after 30mins, 10ml of 1N sodium hydroxide (NAOH) was added to each of the sample in the crucible. The samples submerged into 10ml of 1N NAOH were placed back into the oven at 100^0C for 1hr (the NAOH is expected to reduce and form a paste like mixture). The samples were brought out again from the oven after 1hr, then expected result was obtained from each of the sample. Finally, 10mls of distilled water was added to each of the sample in the crucible, they were filtered using filter paper.

Blood Processing Procedure

5mls of 10 different blood samples were collected, 3mls of the samples was added into a sterile container and 2mls in fluoride oxide container. The samples in the plain container were spun with a centrifuge at 400RPM and the supernatant were separated into a different plain container.

Determination of correlation sodium Concentration

The methods use N-bromosuccinimide (NBS) as an oxidant and three dyes, amaranth, methylene blue, and indigo carmine, as auxiliary reagents. The three methods are based on oxidation reaction of montelukast sodium with a known excess of N-bromosuccinimide (NBS) in acid medium, followed by determination of unreacted NBS by the reaction with a fixed amount of dyes, amaranth, methylene blue, and indigo carmine followed by the measurement of the absorbance at 520, 664 and 610 nm, respectively

Choride Concentration Determination of correlation

In the coulometric measurement of chloride ions, silver ions (Ag^+) are generated at a constant rate by an electrode and released into a dilute acid solution. There they combine with Cl^- ions in the test sample to form an insoluble precipitate, AgCl. When all Cl^- is removed from solution, an excess of Ag^+ ions is detected by a sensor and the titration is stopped. Because the rate of Ag^+ ion generation is constant, the amount of time required to remove all Cl^- ions is directly proportional to concentration

Statistical Analysis

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Data were analyzed with the Statistical Package for Social Sciences (SPSS) program (SPSS Inc., Chicago, IL, USA; Version 18–21) and Microsoft Excel. A one-way ANOVA (Post Hoc) was used in comparing the means and standard deviation of the various biochemical parameters of the various groups of the study. Tables and charts were used for the presentation of various biochemical finding, and find the correlation of the selection cation

RESULTS

The table below shows the mean concentration and standard deviation of biochemical biomarkers of the sample groups. Results were expressed as mean ± standard deviation. One-way Anova (Post hoc) was calculated at 95% confidence interval and statistically significant results are ≤ 0.05.

Table 4.1 from the result, there is a statistically significant ($p < 0.05$) in correlation of sodium and chloride concentration and it is significant.

Table 1 Multiple Comparison between Various groups of Sample Groups

Parameters	Blood	Hair	NaoH	F-Value	P-Value
Sodium (mmol/L)	489.70 ± 14.65_a	631.50 ± 80.53_a	685.00 ± 9.47_a	32.55	0.00
Chloride (mmol/L)	-675.88 ± 140.15_a	675.88 ± 140.15_a	1306.85 ± 161.83_a	33.69	0.00

Table 2 from the result, there is no statistically significant correlation ($p > 0.05$) in correlation sodium and chloride concentration.

Table 2 correlation between blood and hair

Parameters	Blood	Hair	R- value	P-value	Comments
Sodium (mmol/L)	489.70 ± 14.65	631.50 ± 80.53	-0.10	0.59	No correlation
Chloride (mmol/L)	-675.88 ± 140.15	675.88 ± 140.15	0.15	0.35	No correlation

Table .3 from the result, there is no statistically significant correlation ($p > 0.05$) in correlation chloride concentration but correlation in sodium acid concentration.

Table 3 Correlation Between Blood and NaoH

Parameters	Blood	NaoH	R- value	P-value	Comments
Sodium (mmol/L)	489.70 ± 14.65	685.00 ± 9.47	1	-0.46	Correlation
Chloride (mmol/L)	-675.88 ± 140.15	1306.85 ± 161.83	1	0.21	No Correlation

Table 4 from the result, there is no statistically significant correlation ($p > 0.05$) in correlation sodium and chloride concentration.

Table 4 Correlation Between Hair and NaoH

Parameters	Hair	NaoH	R- value	P-value	Comments

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Sodium (mmol/L)	631.50 ± 80.53	685.00 ± 9.47	-0.46	1	No correlation
Chloride (mmol/L)	675.88 ± 140.15	1306.85 ± 161.83	0.21	1	No correlation

DISCUSSION

Blood, hair, and NaoH are statistically significant, and there is a significant increase in blood concentration correlation and stability of sodium blood (table 4.1). Sodium and chloride are common table salts, and although sodium cation and chloride anions are similar, there was no correlation in sodium and chloride [11,12]. This indicates that hair is not a suitable parameter for analysis of hair. This study disagrees with [13], and there is a significant correlation between blood and hair for sodium and chloride. This study disagrees with [14,15]. Trace elements in the blood and blood of clinical health companion dogs to determine whether blood and blood element concentrations correlate with each other, and to evaluate the impact of age, sex, hair color, and diet on these aspects [16]. In similar vein, the correlation study found no significant association and between (table 4.2-4.4) these demonstrated no correlation in hair and blood, consequently, parameter such as sodium and chloride no indexed in correlation.

CONCLUSION

Hair analysis can be used in clinical practice for monitoring medication effects, determining a patient's nutritional state, and conducting studies that seek to correlate blood and hair. Hair analysis can be used to track the body's levels of hazardous substances or setting drugs, as well as to identify nutritional deficiencies like anemia. Hair analysis is a non-invasive and efficient technique that can be used to supplement conventional medical testing, even if it is not as precise as blood analysis.

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