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Exploring the Anthropometric Attributes of Cosmetologists in Yenagoa, Nigeria

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Cosmetologists are generally defined as individuals who work in retail- or home-based salons and provide a wide range of beauty services, including hair shampooing and styling, manicures, pedicures, and scalp and facial treatments. Hairdressing and cosmetology are common occupations, and several million individuals are employed as hairdressers and cosmetologists (HC) worldwide. Hairdressers can be exposed to a variety of chemicals on a daily basis, due to their use of hair products, shampoos, permanent wave solutions, hair dyes, and hair sprays. Reproductive toxic effects have been reported for some of these agents. The study was conducted in Yenagoa Local Government Area (YELGA), Bayelsa State. The State is a cosmopolitan state in the southern part of Nigeria, which is geopolitically located within Latitude 415 North, 523 South, Latitude 522 West and 645 East. It has an area of 706km. Ethical approval was sought from the Ethical Committe ll of Niger Delta University, Wilberforce Island, Bayelsa state, Nigeria. It was carried out with compliance with the principle of Helsinki declaration of 1975 as revised in 2008. Informed consent was obtained from all the recruited volunteers who were made to know the reasons their blood and urine samples were needed for the research. A total number of twenty five (25) Urine and Blood samples were randomly selected from cosmetologist in yenagoa.The most common chemicals mentioned in this study are nitrosamines in hair dye, toluene in nail polish, and formaldehyde in both hair dye and nail polish. This study shows that the health status of cosmetologists residing in yenagoa local government area are not affected by the chemicals they are exposed to, due to the fact that the parameters worked on are unable to pick out certain abnormalities that may determine the overall health status of these subjects. The abnormalities observed from this study may arise from an individual's overall health status, genetic predisposition, lifestyle and personal hygiene.

Keywords: Cosmetology, Anthropometry, Bicarbonate, Formaldehyde, Nitrosamine, Toulene.

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Introduction

Cosmetologists are generally defined as individuals who work in retail- or home-based salons and provide a wide range of beauty services, including hair shampooing and styling, manicures, pedicures, and scalp and facial treatments. Hairdressing and cosmetology are common occupations, and several million individuals are employed as hairdressers and cosmetologists (HC) worldwide (European Agency for Safety and Health at Work 2014). Workers in the hairdressing and cosmetology professions are predominantly women, and many of these women are of childbearing age (Halliday-Bell *et al*., 2009) and begin working before considering family planning (Baste et al. 2008). Therefore, this situation raises concerns that these women of reproductive age could be susceptible to the effects of exposure to potential reproductive toxins. Several studies of HC have suggested that their work might adversely affect their reproductive health (Herdt-Losavio *et al*., 2009; Ronda *et al*., 2010; Jørgensen *et al*., 2013; Quach *et al*., 2014), although various studies have reported conflicting findings. For example, several studies have reported that HC have an increased risks of infertility (Baste *et al*., 2008), a time to pregnancy of >12 months (Kersemaekers *et al*. 1997), spontaneous abortion (Ronda *et al*., 2010), low birth weight (Halliday-Bell *et al*., 2009; Herdt-Losavio *et al*., 2009), and preterm delivery (Halliday-Bell *et al*., 2009), compared to women in other occupations or in the general population. However, other studies have found little or no evidence of an increased reproductive health risk among female hairdressers (Hougaard*et al*., 2006; Gallicchio*et al*., 2011). As a profession, cosmetology is predominantly female inclined, most of whom are of reproductive age. There are more than one million women registered and licensed as cosmetologists in the United States and roughly several million more work as hair stylists. Among cosmetologists, hairdressers and nail technicians make up a large part of the working population. Many cosmetologists begin their careers before reproductive age and before family planning, which may put them at higher risk for reproductive health effects from exposure to workplace cosmetology chemicals. The most common chemicals mentioned in select studies about hair dye and nail polish were nitrosamines in hair dye, toluene in nail polish, and formaldehyde in both hair dye and nail polish.

NITROSAMINES

The primary ingredient in hair dyes is aromatic amines, which are precursors of nitrosamines (McCall et al., 2005). Nitrosamines require bioactivation and have shown mutagenicity in vitro and carcinogenic properties in vivo (Holly, Bracci, Hong, Mueller, & Preston-Martin, 2002). The actual reproductive risk of nitrosamines is unclear due to limited data (Kersemaekers *et al*., 1995).

TOLUENE

The organic solvent toluene, a common ingredient in nail polish and among the most common exposures in the workplace, has been linked to less fetal growth and shorter pregnancy duration (Hannigan and Bowen, 2010). Rapidly absorbed through the lungs, toluene vapors are distributed to highly perfused and fatty tissues. Organic solvents such as toluene have an affinity for lipid-rich tissues and readily cross the placental barrier (Bukowski, 2001). Little is known about the mechanisms of action for toluene; it is unclear how it is absorbed and distributed through the body (Hannigan and Bowen, 2010).

FORMALDEHYDE

Formaldehyde is found in both hair dye and nail polish. Formaldehyde is considered a human carcinogen by the IARC, the U.S. National Toxicology Program (NTP), the U.S. Environmental Protection Agency (EPA), and the

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Occupational Safety and Health Administration (OSHA). Formaldehyde has been associated with nasal cancers in workers exposed in occupational settings (Agency for Toxic Substances and Disease Registry [ATSDR, 1999; EPA, 2010; NTP, 2010). Formaldehyde has been named a Group 1 carcinogen by the IARC, meaning that "there is sufficient evidence in humans for the carcinogenicity of formaldehyde" (WHO and IARC, 2006). The NTP classified formaldehyde as "reasonably anticipated to be a human carcinogen," although there is currently a proposal to reclassify formaldehyde as "known to be a human carcinogen" (NTP, 2010). Reproductive and developmental toxicity have been speculated to be associated with formaldehyde for some time, but this has not been confirmed. Although a small number of human studies have suggested that formaldehyde exposure may cause reproductive toxicity, the current understanding of the mechanisms of action is limited. Currently, formaldehyde's mechanisms of action are proposed to induce reproductive and developmental toxicity via genotoxicity, oxidative stress, disruption of the activity of proteins, enzymes, and hormones important for the maturation of the male reproductive system, apoptosis, and DNA methylation (Duong *et al*., 2011). These mechanisms are hypothetical and require validation, particularly for reproductive system effects (Duong *et al*., 2011).

The majority of studies showing occupational reproductive effects among hairdressers and nail technicians suggest that chemical exposure is the probable cause of these findings (Ronda *et al*., 2009). However, the effects of exposures to mixtures of chemicals, such as those found in salons, are largely unknown (Hougaard *et al*., 2006). The evidence is inconclusive regarding hair dyes and potential human carcinogenicity. Regarding carcinogenicity, the primary concern is chemical absorption through human skin (McCall*et al*., 2005). However, the level of absorption depends on the extent of dermal contact (Kersemaekers *et al*., 1995). Hair dyes are found in many forms (i.e., liquids, creams, gels, shampoos, and rinses), and the method of application may affect exposure. As an example, permanent cream dyes are commonly applied with a brush, whereas other dyes are more often worked into the hair by hand. The major route of entry for hair dye chemicals is cutaneous absorption (Kersemaekers *et al*., 1995).The main concern with nail polish is inhalation exposure. Working in close proximity to multiple agents exposes nail technicians to potential sensitizers and respiratory irritants.

(Reutman *et al*., 2009). Nail technicians commonly inhale and breathe harmful vapors, dusts, or mists, and can get the product on their skin or in their eyes or can swallow the product if it is accidentally transferred onto food or cigarettes (OSHA, 2013). These exposures can accumulate if the products are used daily or if poor ventilation exists in salons (OSHA, 2013). Chemical exposure over time is a concern. Several other potentially hazardous chemicals can affect workers in nail salons. Acetone (nail polish remover) can cause headaches, dizziness, and eye, skin, and throat irritation. Acetonitrile (fingernail glue remover) can cause nose and throat irritation, breathing problems, nausea, and vomiting. Ethyl methacrylate (artificial nail liquid) can cause asthma, eye, skin, nose, and mouth irritation, and reproductive effects for the fetus if exposure occurs during pregnancy (OSHA, 2013).

MATERIALS AND METHODS

Study Area

The study was conducted in Yenagoa (YELGA), Bayelsa State. Bayelsa State is a cosmopolitan state in the southern part of Nigeria, which is geopolitically located within Latitude 415 North, 523 South, Latitude 522 West and 645 East. It has an area of 706km. It shares boundaries with Delta State on the North, Rivers State on the East

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with the Atlantic Ocean on the West and South. The official language is English language but the major language spoken is the Izon language.

Ethical clearance

The study which got the ethical approval from the Ethical Committee of Niger Delta University, Wilberforce Island, Bayelsa state, Nigeria. It was carried out with compliance to the principle of Helsinki declaration of 1975 as revised in 2008. Informed consent was obtained from all the recruited volunteers who were made to know the reasons their blood and urine samples were needed for this research.

Sample collection

A total number of twenty five (25) Urine and Blood samples were randomly selected from cosmetologist in yenagoa.

Sample Size Calculation

Taro Yamane formula with 95% confidence level according to Yamane, 1973, was used to determine the sample size of this research (Yamane, 1973). Calculation of sample size using the Taro Yamane method $n = \frac{N}{1+N(e)2}$

Where n = sample size required N = Population size e = Allowable error which is between 0.01-0.05

Assuming N=25 and e =0.1, therefore

$n = \frac{100}{1+100(0.1)2}$

Therefore, n = 25

Experimental design: Venous blood and Urine were collected from 13 males and 12 females making a total of 25 adult individuals. The blood was used to assay for Packed Cell Volume (PCV) and urine was used for urinalysis.

Materials, Equipment and Reagent

Materials: Capillary tubes, sealant, Microhaematocrit reader, EDTA anticoagulated container, plain universal container, methylated spirit, cotton wool, 5ml syringe, and Combi 11.

Equipment: Microhaematocrit centrifuge (Vanguard V6000).

Packed Cell Volume (PCV)

Principle of test

Blood specimen is centrifuged in a sealed capillary tube and Packed Cell Volume is determined by a special haematocrit reader and gives the result as percentage.

Materials provided with the kit:

- Microhaematocrit reader
- Capillary tubes
- Sealant
- Marker pen

Materials required but not provided:

• Non

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Storage of Test Kits and Instrumentation

Urinalysis

Principle of test

The Urinalysis Reagent Strips (Urine) are firm plastic strips onto which several separate reagent areas are affixed. The test is for the qualitative and semi-quantitative detection of one or more of the following analytes in urine: Specific Gravity, pH, Leukocytes, Nitrite, Protein, Glucose, Ketone Bodies, Urobilinogen, Bilirubin, Blood, and Ascorbic Acid. **Reagents**

Materials provided with the kit:

• Medi Test Combi 11

Materials required but not provided:

• Non

Statistical Analysis

All the values were expressed as mean ± standard deviation of triplicate determinations. The data obtained from the analysis was subjected to one way Analysis of variance (ANOVA) and t-test, the means were separated and compared at 95% confidence level.

RESULTS

Table 4.1: Socio-demographic distribution

TEST	CONTROL	
SEX		
Male	13	07
Female	12	18
Sub-total	25	25
MARITAL STATUS		
Single	23	21
Married	02	04
Sub-total	25	25
TYPE OF DIET		
Carbohydrate	01	02
Protein	02	00
Carbohydrate/protein	22	23
Sub-total	25	25
WORK HOURS		
7am – 9pm	02	00
8am – 4pm	01	21
8am – 5pm	00	01
8am – 8pm	02	00
8am – 9pm	18	03
8am – 10pm	02	00
Sub-total	25	25

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Table 4.2: general descriptive statistics of test against control category. Results are expressed as mean ± standard deviation and statistical significance set at P≤0.05, which is calculated at 95% confidence interval.

TEST	CONTROL	P-VALUE	REMARK
AGE	24.08±3.65	27.92±11.96	0.001	S
PCV	36.88±9.06	34.68±7.60	0.121	NS
BLOOD PRESSURE	115/72±11.54	119/72±8.67	0.225	NS
BMI	21.94±3.01	25.83±5.68	0.225	NS
PULSE RATE	72.48±13.38	75.24±13.86	0.111	NS
HEIGHT	5.48±0.24	5.44±0.46	0.291	NS
WEIGHT	60.96±10.88	68.64±11.48	0.254	NS

Table 4.3: gender based analytics of test category. Results are expressed as mean ± standard deviation and statistical significance set at P≤0.05, which is calculated at 95% confidence interval.

	MALE	FEMALE	P-VALUE	REMARK
AGE	25.46±4.21	22.58±2.23	0.217	NS
PCV	39.15±7.67	34.42±10.11	0.118	NS
BLOOD PRESSURE	117/75±13.79	113.69±10.73	0.255	NS
BMI	22.75±2.40	21.06±3.44	0.121	NS
PULSE RATE	69.54±12.71	75.67±13.90	0.411	NS
HEIGHT	5.56±0.24	5.40±0.22	0.191	NS
WEIGHT	66.00±10.13	55.50±9.14	0.001	S

Table 4.3: Urine analysis demographics of test against control category.

TEST	CONTROL	
COLOUR		
Amber	22	21
Straw	00	01
Pale	02	03
Amber/cloudy	01	00
Sub-total	25	25
LEUCOCYTE		
Negative	20	25

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(+)	00		00	
(++)	05		00	
Sub-total	25		25	
NITRITE				
Negative	25		25	
Positive	05		00	
Sub-total	25		25	
PH	14		12	
5	06		08	
6	01		00	
6.5 7	02		03	
8	02		02	
Sub-total	25		25	
BLOOD				
Negative			24	23
Trace	00		01	
(+)	01		01	
Sub-total			25	25
PROTEIN				
Negative	23		20	
Normal	00		02	
(+)	02		02	
(++)	00		01	
Sub-total	25		25	
GLUCOSE				
Negative	25		21	
Normal	00		02	
(+)	00		02	
Sub-total	25		25	
ASCORBIC ACID				
Negative	24	25		
(+)	00		00	
(++)	01		00	
Sub-total	25	25		
KETONE	25		23	
Negative	00		02	
Normal	25		25	
Sub-total				
UROBILINOGEN	22		25	
Normal	03		00	
(+)	25		25	
Sub-total				

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BILIRUBIN					
Negative	22		23		
Normal	00		02		
(+)	02		00		
(++)	01		00		
		Sub-total	25		2

DISCUSSION

From this study, blood and urine samples were collected from 25 individuals in the cosmopolitan city of Yenagoa. From the 25 individuals, 13 were males and 12 were females, 23single and 2 married. 1 individual was on a carbohydrate diet, 2 were on a protein diet, and 22 were on a carbohydrate/protein diet. Out of the 25 individual sampled, 2 worked from 7am-9pm, 1 worked from 8am-4pm, 2 worked from 8am-8pm, 18 worked from 8am-9pm and 2 worked from 8am10pm.

From table 4.2 It was observed that the p-value of the average age (25.46±4.21years) of the individuals is 0.001 which is significant to the study as statistical significance was set at P≤0.05. It was also observed that P-value of the average Packed Cell Volume (36.88±9.06%) is 0.121, Blood pressure (115/72±11.54mmHg) is 0.225, Body Mass Index (21.94±3.01kg/m2) is 0.225, Pulse rate (72.48±13.38bpm) is 0.111, Height (5.48±0.24ft) is 0.291 and Weight (60.96±10.88kg) is 0.254, all of which were seen to be statistically insignificant based on the study carried out.

Table 4.3 shows gender based analytics of the test group. It was observed that statistical significance was evident only in weight for both males and females which was expressed as 0.001 but was not observed for other groups which were all statiscally insignificant with a P≤0.05.

Table 4.4 shows the urine analysis demographic of the test category and results were obtained for different analytes. Out of the Twenty five (25) urine samples, 22 were amber colored, 2 were pale colored and 1 was amber/cloudy. (20) reacted negative for leucocyte and 5 reacted positive (++) for leucocyte which is suggestive of an ongoing Urinary tract infection (UTI) in those individuals. 20 samples reacted negative for nitrite and 5 reacted positive for nitrite which is also suggestive of a UTI. 14 samples had a pH of 5.0, 6 samples had a pH of 6.0, 1 sample had a pH of 6.5, 2 samples had a pH of 7.5, and 2 samples had a pH of 8.0. 24 samples reacted negative for blood and 1 reacted positive (+) which may be due to an underlying health condition. 23 samples reacted negative for protein and 2 samples reacted positive (+) for protein.

25 samples reacted negative for glucose. 24 samples reacted negative for ascorbic acid and 1 reacted positive (++) which suggest an intake of vitamin C before the sample was collected. 25 samples reacted negative for ketones. 22 samples had normal urobilinogen and 3 had abnormal (+) urobilinogen. 22 samples reacted negative for bilirubin 2 reacted positive (+) and one reacted positive (++) for bilirubin.

CONCLUSION

Cosmetologists are individuals who work in retail or home-based salons and provide a wide range of beauty services, including hair shampooing and styling, manicures, pedicures, and scalp and facial treatments. This exposes them to different chemicals and toxic substances which can be hazardous to their reproductive health. The most common chemicals mentioned in this study are nitrosamines in hair dye, toluene in nail polish, and

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formaldehyde in both hair dye and nail polish. This study, shows that the health status of cosmetologists residing in yenagoa local government area are not affected by the chemicals they are exposed to, due to the fact that the parameters worked on are unable to pick out certain abnormalities that may determine the hormonal and electrolytes levels of the individuals, which are a major pointer to determine hormones (oestrogen and testosterone) which are responsible for reproduction and electrolytes (Potassium, Sodium, Chloride and Bicarbonate) that are essential for basic life functioning. The abnormalities observed from this study may arise from an individual's overall health status, genetic predisposition, lifestyle and personal hygiene.

RECOMMENDATION

• Cosmetologist should wear protective gear (latex gloves, nose mask, face shields, hair nets etc.) to prevent exposure to toxic chemicals.

• Working hours should be adjusted as long working periods stresses the body and may affect overall health and reproductive status.

• Another study should be carried out and should include hormonal assay of the individuals to ascertain their hormonal status.

• Further studies should be carried out to better understand the effect of different chemicals (toluene, formaldehyde, nitrosamines) on reproductive and health status.

COMPETING INTEREST

No competing interest.

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