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AQUEOUS EXTRACT OF SIDA ACUTA ATTENUATES NICOTINE-INDUCED CEREBELLAR DYSFUNCTION IN ADULT MALE RATS

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Running Title: Aqueous extract of *Sida acuta* elicits neuroprotective effect

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ABSTRACT

Sida acuta (SA) has a variety of traditional uses spanning from its fresh root that is chewed for the treatment of dysentery to hot aqueous extract of dried plant orally administered as diuretic. The aqueous extract of the plant has antimicrobial, antimalarial, analgesic and antiplasmodial effects. This study was designed to investigate the neuroprotective effects of the aqueous extract of the leaves of SA in nicotine-induced cereballar dysfunction. Adult male Wistar rats were randomly separated into the following groups: Vehicle (received distilled water), Nicotine-treated (NIC-treated; received 1.0mg of Nicotine per kg of body weight), SA-treated (received 500mg/kg of body weight of aqueous extract of SA) and NIC+ SA-treated (received 1.0mg of Nicotine and 500mg of SA per kg body weight). The treatment lasted for 28 days and the administration was done daily by oral gavage. The body weight change was monitored using standard animal weighing balance; biochemical assay and cerebellar tissue histology were performed as previously described. The results showed increase in body weight gain and disruption of cytoarchitecture of the cerebellum in nicotine-treated group compared with vehicle-treated group. These alterations of cerebellar morphology may be associated with increased oxidative stress. However, concomitant administration of aqueous extract of SA during treatment with nicotine attenuated cerebellar disruption. The result indicated that administration of aqueous extract of the leaves of SA during treatment with nicotine preserves cerebellar function.

INTRODUCTION:

Nicotine is one of the main components of tobacco or cigarette which have psycho stimulant properties similar to amphetamine [1,2,3]. The effects of nicotine are well documented in humans and animals, both in vivo and in vitro [4,5,6]. These effects include the following; increase in blood pressure,

3

mobilization of sugar and catecholamines level of blood [4], alteration of antioxidant defense mechanisms [7], contribute to development of lung cancer [8], hepatic toxicity, infertility [9] etcetra. Studies have shown that nicotine abuse induces oxidative stress, apoptosis and inflammation in brain cells [10]. In addition, nicotine-induced neurotoxicity has been reported to be more pronounced in some brain regions like hippocampus, amygdala and cerebellum [11,12]. The deleterious toxic effects of nicotine have been linked to increased production of reactive oxygen species (ROS) [13,14]. ROS damages DNA, proteins, carbohydrates, and lipids and affects enzyme activity and cellular genetic machinery [13]. However, the biological systems possess a number of mechanisms to remove ROS, such as the integrated antioxidant defense systems [13,15] and also, in recent years, herbal/natural compounds with medicinal values have gained a striking attention in providing enhancement to endogenous defense mechanism. Natural flavonoids and their derivatives are being widely considered as supplementary therapeutics against neurodegenerative diseases [6,16].

Sida acuta is an erect, branched small perennial herb or shrub which grows abundantly on cultivated fields, waste areas, roadsides and open land areas in tropical and subtropical regions [17, 18]. It is commonly known as broom grass, broom weed, clockplant, common fan petals and common wire weed. *Sida acuta* has a variety of traditional uses. In Central America, the plant is used to treat asthma, renal inflammation, colds, fever, headache, ulcers and worms [19], in Colombia the plant is known for the treatment of snake bites [20], in West Africa, particularly in Burkina Faso and even Nigeria, the plant is traditionally used in the treatment of malaria, diarrhea and many other diseases [21].. The hot aqueous extract of the dried entire plant is administered orally in India as a febrifuge, diuretic and to prevent vomiting and gastric disorders [22,23].. In Papua New Guinea, the fresh root is chewed for the treatment of dysentery [24].

In addition, several studies have reported the effectiveness of this noble plant as antimalaria, antiulcer, worm expeller, antipyretic, antidiarrhea, antiplasmodial, analgesic and antidepressant [25,26,27]. In Nigeria, S. acuta is one of the plants most commonly used for the treatment of hypertension, erectile dysfunction and hemorrhoids [28,29]. The pharmacological activities of S. acuta have been linked to its components which include: alkaloids such as vasicine, ephedrine and cryptolepine (the main alkaloid in the plant) [18], saponosides, coumarins, steroids, tannins, phenolic compounds (evofolin-A and B),

scopoletin, loliolidand4-ketopinoresinol, polyphenol, sesquiterpene and flavonoids [30]. This current study attempted to investigate the ameliorative effect of S. acuta on nicotine-induced cerebellar dysfunction in adult male rats.

MATERIALS AND METHODS:

Preparation of the extract:

Samples of *S. acuta* were collected locally. The plant was botanically authenticated in the Department of Plant Biology, University of Ilorin, Nigeria. Authentication number UIV 14 was issued and the plant was deposited at the herbarium. The leaves of the plant were air-dried and pounded into powder using pestle and mortar and kept in an air-tight container. 580 g of the sample was percolated in distilled water for 48 hours and stirred intermittently with magnetic stirrer. It was filtered and the filtrate was evaporated in steam bath until substantial water has been removed. It was later dried in the oven at 37°C to concentrated extract.

Animals, Grouping and protocol:

Twenty adult male Wistar rats weighing 180-210g were obtained from the animal house, College of Medicine and Health Sciences, University of Ilorin, Ilorin, Kwara State, Nigeria. The rats were housed in wire mesh cages and maintained in a well ventilated room at 25±2 ∘C, on a 12-h light/12-h dark cycle. Rats had unrestricted access to standard rat chow and

tap water. After acclimatized for two weeks, the rats were randomly distributed into four groups (n=5); Vehicle (received distilled water), Nicotine-treated group (NIC-treated; received 1.0mg nicotine per kg body weight (b.w)), SA-treated (received 500mg per kg b.w of aqueous extract of SA) and NIC+ SA-treated (received 1.0mg of nicotine plus 500mg/kg b.w of SA). The treatment lasted for 28 days and the administration was done daily by oral gavage. The investigation was conducted in accordance with the National Institutes of Health Guide for the Care and Use of Laboratory Animals [31] and was approved by the Institutional Review Board of University of Ilorin. Every effort was made to minimize both the number of animals used and their suffering. Initial and final body weights were monitored using animal weighing balance (Olympia SCL66110 model, Kent Scientific Corporation, Torrington, CT06790, USA) and the body weight gain were obtained.

Sample preparation and biochemical analysis:

At the end of treatment, the rats were anesthetized with pentobarbital sodium (50 mg/kg, i.p). Blood was collected from the apex of the heart into heparinized bottle and centrifuged at 3000 rpm for 15 minutes using a bench centrifuge and the plasma was stored frozen until it was needed for biochemical assay. Biochemical analysis of plasma malondialdehyde (MDA), which is a marker of lipid peroxidation and superoxide dismutase

(SOD) an antioxidant were performed using assay kits obtained from Randox Laboratory Ltd. (Co. Antrim, UK) [32].

Tissue homogenate:

The cerebella were excised, blotted and weighed. After weighing, 500mg of tissue was carefully removed and homogenized with a glass homogenizer following centrifugation at 3000rpm for 10 minutes. Supernatant was used for the measurement of Glucose-6- phosphate dehydrogenase (G6PDH) and Glutathione peroxidase (GPX) activities by standardized enzymatic colorimetric methods using assay kit obtained from Randox Laboratory Ltd. (Co. Antrim, UK) [33].

Histology:

The cerebellar tissues were fixed in 10% buffered formol saline for histological examination using hematoxylin and eosin (H&E) staining techniques and examined microscopically.

Statistical analysis:

All data were expressed as means ± SEM. Statistical group analysis was performed with SPSS, version 22 of statistical software. One-way analysis of variance (ANOVA) was used to compare the mean values of variables among the groups. Bonferroni's test was used to identify the significance of pair wise comparison of mean values among the groups. Statistically significant differences were accepted at $p<$ 0.05.

RESULTS:

Effect of aqueous extract of SA on body weight in nicotine-treated male rats:

Table 1 depicts the effect of administration of SA and nicotine on body weight. The results showed significant loss in body weight during treatment with nicotine alone when compared with vehicle-treated group. However, concomitant treatment with aqueous extract of SA during treatment with nicotine significantly improved the body weight ($p<0.05$).

Effect of aqueous extract of SA on the histology of cerebellum in nicotine-treated male rats:

H & E stained section of cerebellar cortex of Vehicle- and SA-treated groups showed the well known normal structure. They showed three distinct layers from outside inwards; the molecular layer, the mono layer of Purkinje cells and the closely packed granular cell layer. The Purkinje cells were arranged in one row between the molecular and granular layers. The granular layer was composed of closely packed numerous small granular cells with dark nuclei (Figure 1a, c). Examination of the photomicrograph of a section of cerebellar cortex in NIC-treated rat revealed disruption of purkinje cell layer, vacuolation of molecular layer and dispersed granular cells with evidence of inflammation (Figure 1b).

Examination of the photomicrograph of a section of cerebellar cortex in NIC+SA-treated rat showed mild disruption of purkinje and granular layers and normal molecular layer (Figure 1d).

Effect of aqueous extract of SA on oxidative stress markers in nicotine-treated male rats: Plasma MDA and SOD are potent biomarkers of oxidative stress. Treatment with nicotine significantly induced oxidative stress with significant increased level of plasma MDA and decreased level of SOD (Figure 2) when compared with vehicle-treated group. However, concomitant administration of SA during treatment with nicotine ameliorated oxidative stress with a decreased level of plasma MDA and a significant increased level of SOD when compared with nicotine-treated group (Fig 2).

Table 1: Effects of aqueous extract of *S. acuta* and nicotine on body weight of adult male rats

Groups	Initial body weight (g)	Final body weight (g)	Body weight change (g)
Vehicle-treated	200.1± 11.0	215.1 ± 10.0	15.0 ± 9.0
NIC-treated	195.5 ± 3.5	191.8 ± 3.5	-3.7 ± 8.2*
SA-treated	187.9± 5.7	197.6± 5.3	10.3± 12.6
NIC+SA-treated	190.4±7.4	214.5 ± 11.5	24.5±13.25#

Data are expressed as mean ± S.E.M. n = 5. (*$p<0.05$ vs. Vehicle; #$p<0.05$ vs. NIC)

Effect of aqueous extract of SA on some cerebellar endogenous defense enzymes in nicotine-treated male rats: Glucose-6-Phosphate dehydrogenase (G6PDH) and Glutathione peroxidase activities are bioindicators of the cellular defense mechanism against oxidative stress. Exposure to nicotine significantly reduced G6PDH and GPX activities compared with the vehicle. Nevertheless, administration of SA during treatment with nicotine significantly increased G6PDH and GPX activities compared with nicotine-treatment group (Figure 4a, b).
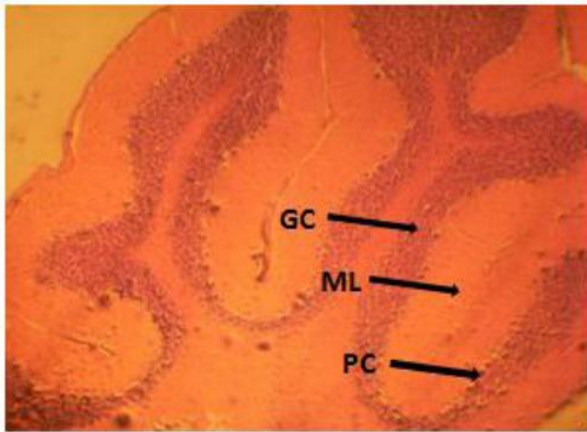
Fig. 1a: Photomicrograph of a section of cerebellum in Vehicle-treated rat
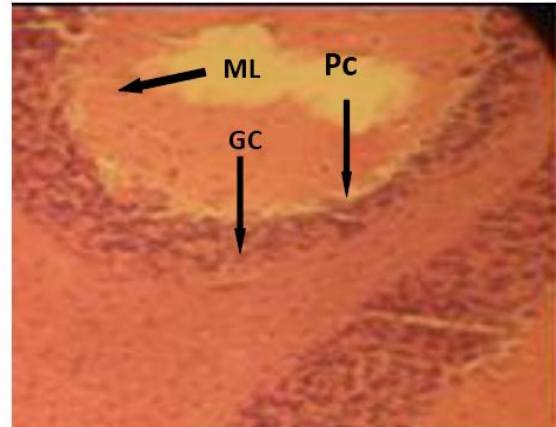
Fig 1b: Photomicrograph of a section of cerebellum in NIC-treated rat
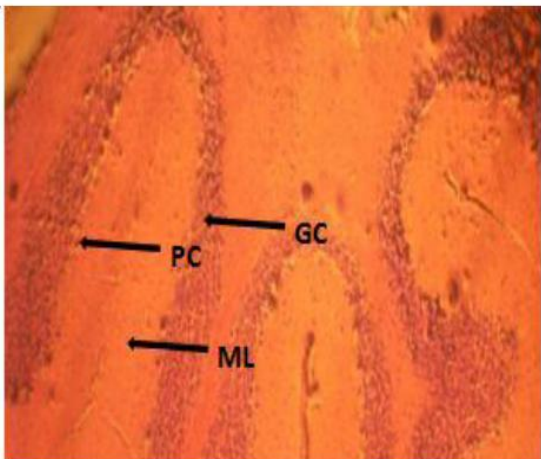
Fig. 1c: Photomicrograph of a section of cerebellum in SA-treated rat
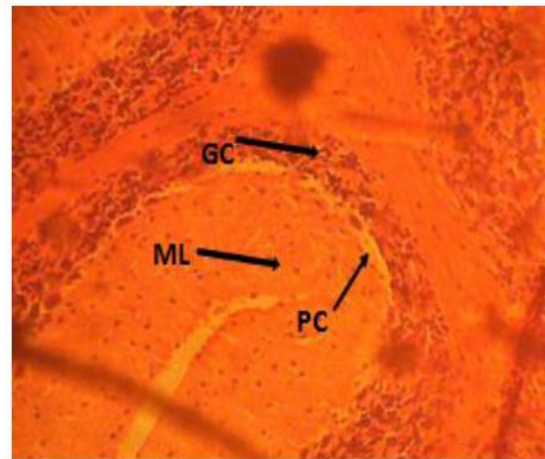
Fig. 1d: Photomicrograph of a section of cerebellum in SA+NIC-treated rat

Vehicle-treated rat, shows normal molecular layer, closely packed granular cell layer and mono layer of purkinje cells, NIC-treated rat, shows disruption of purkinje cell layer, vacuolation of molecular layer and dispersed granular cells with evidence of inflammation, SA-treated rat, shows normal molecular layer, closely packed granular cell layer and mono layer of purkinje cells and NIC+SA-treated rat, shows mild disruption of purkinje and granular layers and normal molecular layer. (H & E paraffin stain; ×200, transverse section).ML (molecular layer); GC (Granular cells); PC (Purkinje cells).
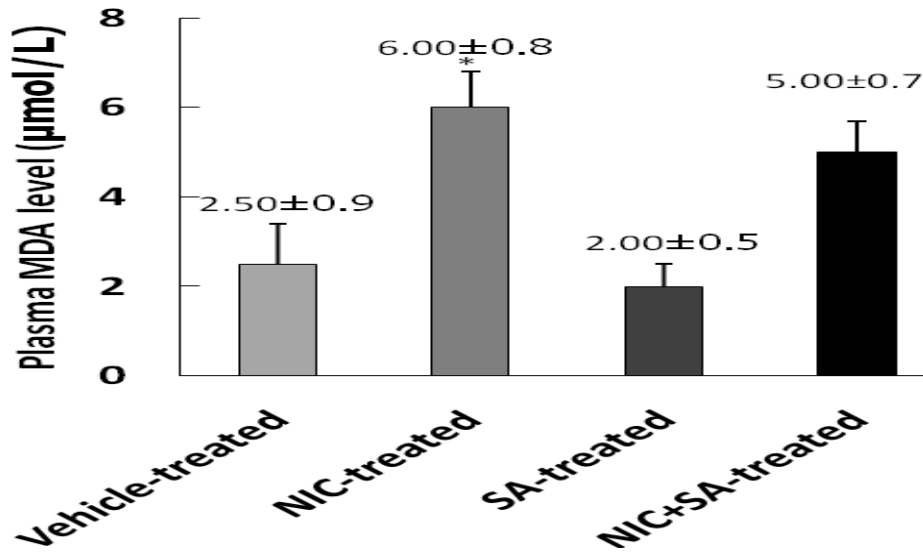
Fig. 2a: Effect of *Sida acuta* and nicotine treatment on plasma MDA concentration of male Wistar rats.
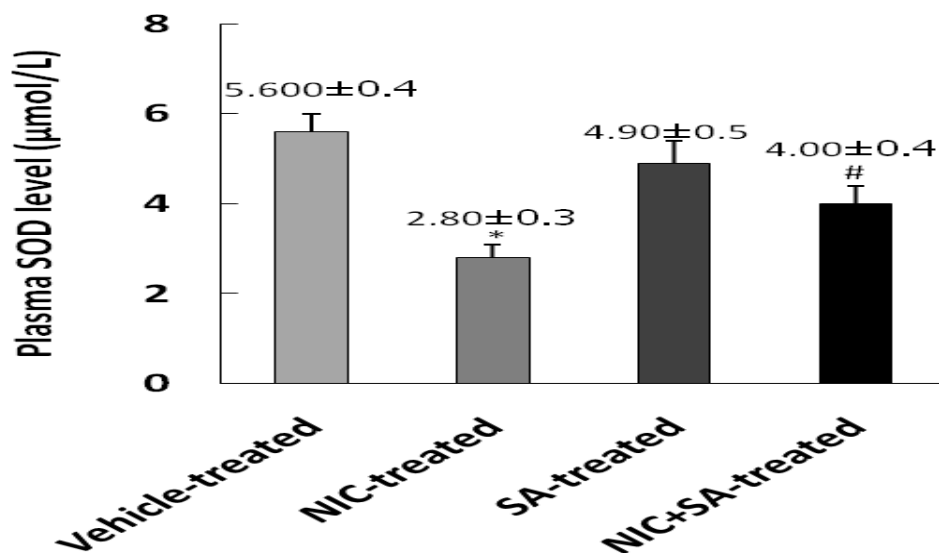
Fig. 2b: Effect of *Sida acuta* and nicotine treatment on plasma SOD concentration of male Wistar rats.

Data are expressed as mean ± S.E.M; n = 5. (* $p<0.05$ vs Vehicle, # $p<0.05$ vs NIC).
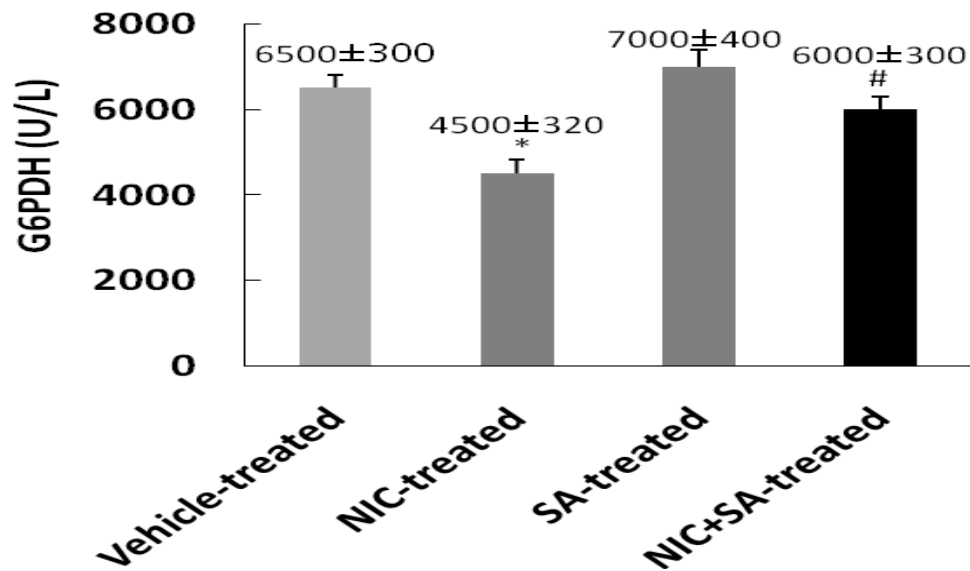
Fig. 3a: Effect of *Sida acuta* and nicotine treatment on cerebellar Glucose-6- Phosphate dehydrogenase activity of male Wistar rats.
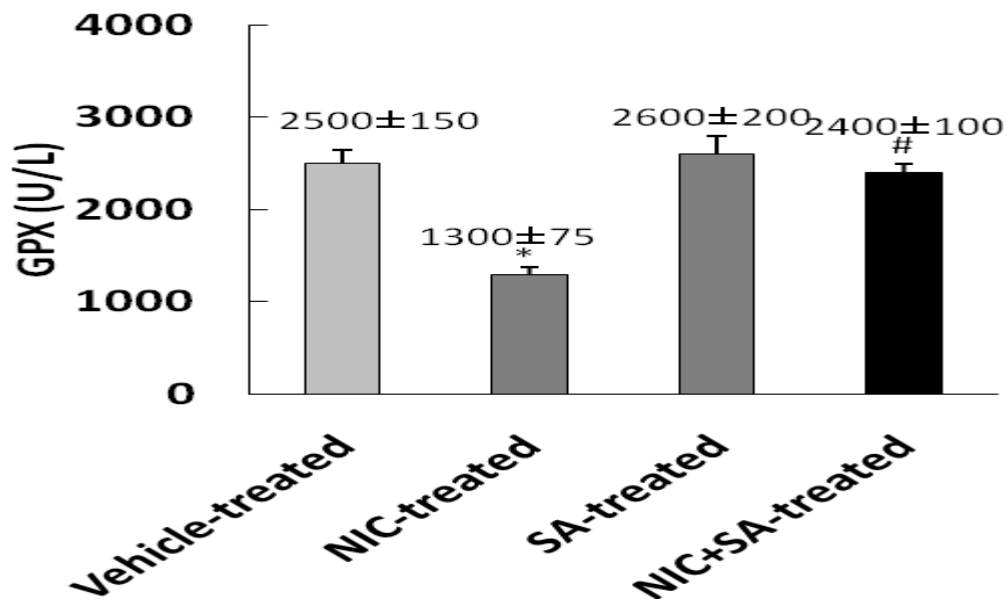
Fig. 3b: Effect of *Sida acuta* and nicotine treatment on Glutathione peroxidase activity of male Wistar rats.

Data are expressed as mean ± S.E.M. n = 5 (* p<0.05vs Vehicle, #p<0.05 vs NIC).

DISCUSSION:

The present study has attempted to investigate the ameliorative effect of aqueous extract of *S. acuta* on nicotine-induced cerebellar dysfunction. Our results indicate that exposure to nicotine led to loss of body weight, disruption of purkinje cell layer, vacuolation of molecular layer and dispersed granular cells with evidence of inflammation in the histology of cerebellar cortex when compared with the vehicle-treated group. These alterations in the cytoarchitecture of cerebellar cortex were associated with increase in plasma MDA level, decrease in plasma SOD level, decreased G6PDH and GPX activities.

However, administration of aqueous extract of *S. acuta* together with nicotine reduces the extent of the loss of body weight, the monolayer arrangement of purkinje cells, molecular and granular layers in the histology of cerebellar cortex.

Nicotine as a psycho-stimulant compound carries a high potential for abuse and addiction [34]. Our present finding that treatment with nicotine causes reduction in body weight is in consonance with previous observation that nicotine intake via smoking or smokeless route caused transient anorexia and increased energy expenditure that reduced body weight in humans as well as in rats [35,36,37]. However, concomitant administration of *S. acuta* and nicotine to rats reduces the extent of loss of body weight, which implies that aqueous extract of *S. acuta* has the capacity to reduce the negative impact of nicotine on normal body weight.

The current pattern of histopathological changes in cerebellar cortex is in line with earlier observation [38]. However, administration of *S. acuta* during treatment with nicotine preserved the distinct structural layers of cerebellar cortex with mild disruption of purkinje and granular layers.

Furthermore, our current results revealed that the altered cerebellar structure and function in nicotine-treated animals was associated with increase in circulating level of MDA and decrease in circulating level of SOD when compared with the vehicle-treated group. Alteration in the circulating levels of MDA and SOD observed in the present study is an indication of oxidative stress, which suggests that nicotine-induced cerebellar degeneration may be mediated by oxidative stress. This finding provides further evidence to previous studies that nicotine abuse induces oxidative stress, apoptosis and inflammation in brain cells [16]. Elevated level of MDA indicates increased lipid peroxidation which damages the cell membrane and causes apoptosis [39, 40. Our present result that treatment with nicotine

led to significant increase in plasma MDA is consistent with earlier studies [16, 40]. The decrease in the circulating level of SOD, G6PDH and GPX activities observed in the current study during treatment with nicotine may indicate an altered cerebellar redox status.

This suggests that the cerebellar tissue disruption observed in the current study may be associated with oxidative stress.

However, concomitant administration of aqueous extract of *S. acuta* during treatment with nicotine seems to reduce nicotine-induced cerebellar toxicity.

CONCLUSION:

The present results suggest that administration of aqueous extract of the leaves of SA during treatment with nicotine preserves cerebellar function which is accompanied with increased SOD, G6PDH and GPX activities.

Conflict of Interest
The authors declare that there are no conflicts of interest.

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DOES THE EXTENT OF CORTICAL MYELINATION AT THE AGE OF ONSET OF SECOND LANGUAGE ACQUISITION (SLA) AFFECT STUDENTS' ACADEMIC PERFORMANCE? A UNIVERSITY OF PAPUA NEW GUINEA CASE STUDY

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ABSTRACT:

The influence of Age of Onset (AO) of Second Language Acquisition (SLA) on learners' Ultimate Attainment (UA) potential is well documented. The issue of Second Language Acquisition (SLA) potential enters a qualitatively different, pragmatic dimension in most multilingual developing nations (including Papua New Guinea), where English, a second language for most children, is also the language of education, and where, consequently, students' English proficiency necessarily affects their academic potential and the quality of their education. This study investigates whether the academic performance of students in the School of Humanities and Social Sciences (SHSS) University of Papua New Guinea (UPNG) is affected by their linguistic backgrounds. Specifically, we examined the effect of three factors in the students' Early Language Education – their Age of Onset of learning English (AO), their Age at Literacy (AGELIT), and their Early Learning Language (ELL) – on their Semester 1, 2017 Grade Points Average (GPA). A purposive cross-sectional sampling method was used for the selection of students. All full-time registered students in the SHSS during the 2017 academic session were eligible to participate in the study. A self-designed pretested questionnaire consisting of nine short questions was used to collect data on SHSS students' language education backgrounds, including their AO, AGELIT and ELL. Our results show a strong and statistically significant inverse correlation between students' AO/AGELIT and their GPAs, as well as a strong positive link between ELL English and students' GPAs, which contrasts sharply with a significant decrease in GPAs in the presence of ELL Tok Pisin. The ELL Vernacular category was too small (sample size N=34) to yield statistically significant results. Our current results corroborate the findings of our earlier studies which established a highly significant inverse correlation between students' AO and their academic performance in the National High Schools, as well as in the University of Papua New Guinea.

Keywords: Second Language Acquisition (SLA), brain maturation, myelination, language education policy, Early Learning Language (ELL), Age of Onset (AO), Age of Literacy (AGELIT), language circuit.

INTRODUCTION:

Advances in neuro- and cognitive sciences have transformed our understanding of post-natal brain development, language origins and language acquisition. The biological foundations of language became the focus of neuroscience research since 1960s, when neurobiologists Penfield & Roberts [1] and Eric Lenneberg [2] first postulated the existence of a Critical Period (CP) in first language acquisition. Vygotsky's ideas regarding the development of verbal thought in the course of social interaction [3, 4] have now been borne out by new imaging technologies which can capture thought development "live". These technologies, particularly functional magnetic resonance imaging (fMRI), have tracked brain development, and mapped brain anatomy to brain function [5].

Researchers now have evidence that language processing is impossible without an efficient transfer of information between various language-supporting regions in separate parts of the brain [6]. Thick bundles of myelinated axons enable those "high-power" connections required for all language-relevant regions to work together as one system. Figure 1 shows that this neural *language circuit* has at least two dorsal and two ventral pathways: the connection between temporal and premotor cortex supports speech production, the connection between temporal cortex and Broca's area supports complex syntax, and the ventral fiber tracts sub-serve semantic and basic syntactic processes [6].
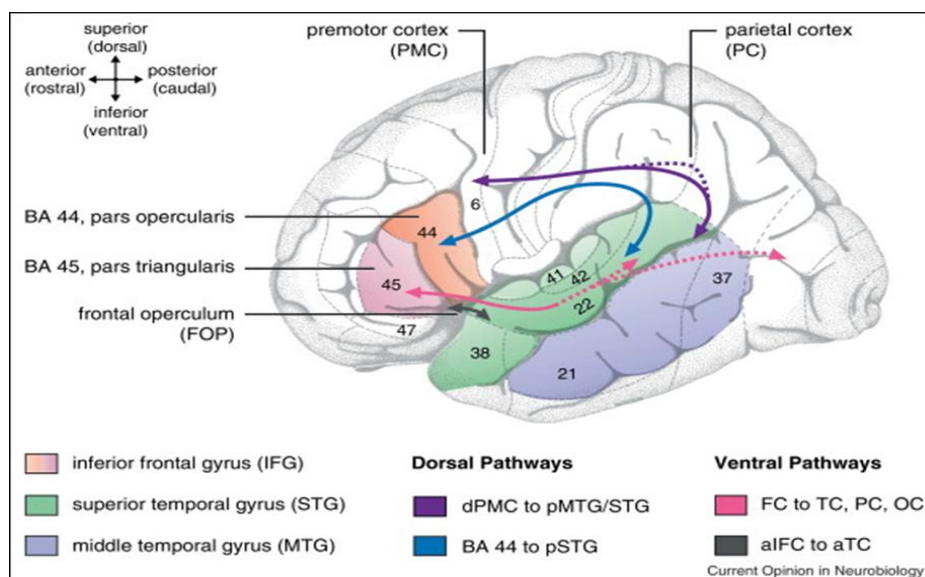
Fig. 1: Language-related regions and high-speed fiber connections in the human brain
{*From: Friederici & Gierhan 2013*} [6]

This biological "language system" is not present at birth; it develops in the course of post-natal brain maturation in response to environmental stimuli (social interaction). The build-up of the "language network" gives rise to what Vygotsky called those structures of language that later become the structures of our thought: "Grammar precedes logic; the speech structures mastered by the child become the basic structures of his thinking" [4].

This integrated *language-thought* structure is unified by high-speed information transfer pathways which develop in the process of myelination of neuronal axons. Myelination starts at the fetus stage and proceeds rapidly in a caudo-cranial direction from the brain stem, advancing from deep to superficial, and from posterior to anterior structures in the brain [7]. By the age of twelve months, the primary sensory and motor areas are myelinated, integrating the processing of visual/auditory signals, and motor functions, necessary for language acquisition.

The higher-order association areas of the cortex in the frontal lobe are myelinated much later, and some neurons in these regions remain unmyelinated in adults [8]. It is now clear that First Language Acquisition (FLA) is a function of the gradual integration of all language-related areas in the course of brain maturation [5, 9, 10]. Bundles of myelinated axons "… form a complete 'ring' that … must be in place in order that syntactic processing work" [10]. To support this claim, Berwick and Chomsky [10] cite diffusion tensor imaging MRI (Fig. 2) to show "how these fiber tracts mature over time, between newborns and adults" [10]. According to the authors, in Fig 2, panel (A) illustrates adult connectivity, in both the left and right hemispheres, while panel (B) displays newborn connectivity. In adults (panel A) the "ring" connecting ventral to dorsal areas is complete, with green, yellow and blue portions indicating the ventral and dorsal fiber connections. However, at birth (panel B), the blue connections are missing; they are not yet myelinated. These are the connections to Broca's area. It is as if the brain is not properly 'wired up' at birth to do syntactic processing.

These fiber tracts mature and become functional by about ages two to three, in line with what we know about language development. The authors also stated that in contrast, at birth the tracts responsible for auditory processing are functional, and during the first year of life children acquire the sound system for their language [10].
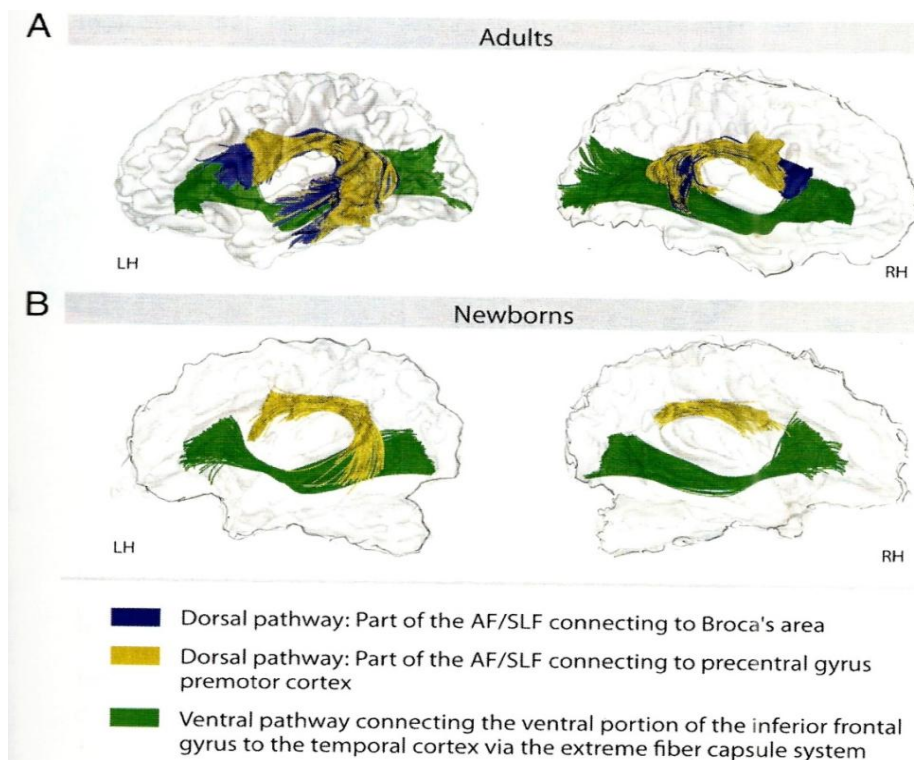
Fig. 2: Dorsal and ventral pathway connectivity in adults vs. newborns (DTI MRI)
{From: *Berwick & Chomsky 2016, Plate 3 (figure 4.5)*} [10]

Cortical myelination causes the brain size to increase dramatically, particularly in the first three years of life. The findings by Kuniyoshi et al. [11] indicated a clear correlation between typical First Language Acquisition (FLA) and a massive increase in brain growth caused by myelination (Fig. 3). According to these authors, speech in babies develops from babbling at around 6 to 8 months of age, to the one-word stage at 10 to 12 months, and then to the two-word stage around 2 years. These obvious developmental milestones of speech production are conditioned by prior speech sound perception which develops much earlier, within the first months after birth, with the myelination of the primary sensory (visual / auditory) and motor areas [11].

MRI studies have consistently found that myelination of language-related areas occurs in two stages: in infancy, and then again at adolescence [12]. Broca's and Wernicke's areas myelinate after the primary sensory and motor areas, but before the higher-order association areas; "around puberty, all cortical areas, except perhaps the higher-order association cortices, have reached their full level of myelination" [8]. Nitin Gogtay et al [7] illustrated (Fig. 4) the extent of the second stage of myelination at puberty.
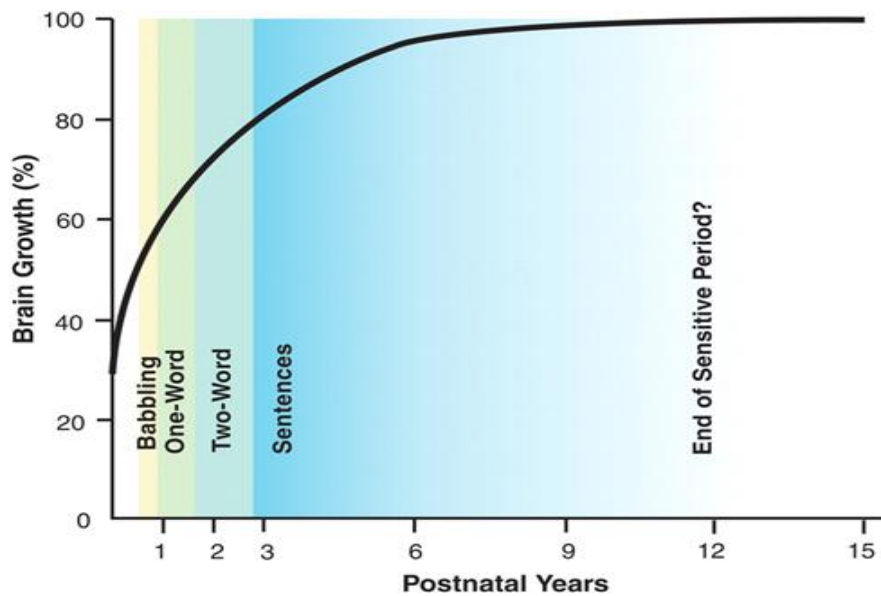
Fig. 3: Myelination, brain growth and first language acquisition (FLA). Human brain weight is presented as a function of age, where 100 on the ordinate correspond to the mean adult value (10). Approximate times of milestones in normal speech development are also indicated. {From: *Kuniyoshi et al.*} [11].
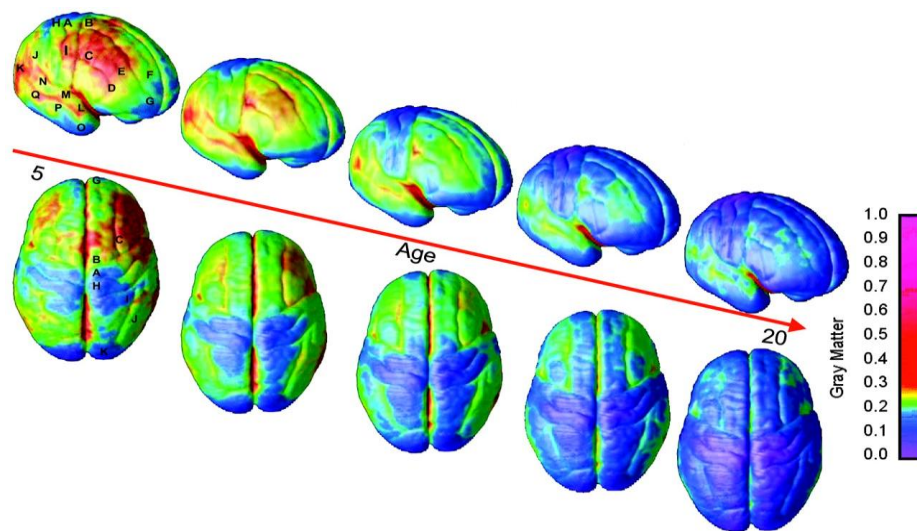
Fig. 4: Right lateral and top views of the dynamic sequence of Grey Matter (GM) maturation over the cortical surface. The side bar shows a color representation in units of GM volume. {From: *Nitin Gogtay et al*} [7]

These significant changes in the brain occur around the time when language acquisition outcomes begin to differ systematically; therefore, there must be a certain "correlation between the two" [8]. This correlation seems to prove the existence of a Critical / Sensitive Period, when humans can learn language with optimal ease [1, 2, 8]. The age constraints on language acquisition potential have been linked to brain maturation [8, 13]. It has been shown that myelin sheaths enveloping neuronal axons make long-distance signal transmission a hundred times faster, but that they also inhibit axons' ability to make short-distance connections with basal dendrites close to the cell body and local branches of the axons (axon "collaterals"). Thus, rapid myelination of the "language areas" at adolescence changes the neurobiological mechanism of Language Acquisition [13].

First Language Acquisition (FLA) relies on short-distance "local" connections between neurons within the "language areas" of the brain. Because those become unavailable as a result of myelination, the higher-order association areas in the frontal lobe become involved in SLA, and learning from direct input, or mere exposure, becomes ineffective. This change in connectivity, it has been argued [8; 13; 15; 17], removes the biological advantage children have in second language acquisition. These claims have attracted a lot of research

interest to the issue of age constraints in SLA in recent years [11, 14], albeit with a focus mainly on Ultimate Attainment (UA) or 'native-likeness' in SLA after puberty [15 – 20]. Unfortunately, our new understanding of the biological foundations of language is yet to influence language education in multilingual societies. The logic of the prevailing view that "children learn better in their mother tongue" (MT) appears to be self-evident; supported by a large body of research [21 – 25] and promoted by UNESCO since 1953 [26], this relatively unquestioned principle has shaped language policy in many post-colonial multilingual societies, where Mother Tongue is widely viewed as the most effective language for literacy and learning throughout primary school [27].

In Papua New Guinea (PNG), Vernacular Education (VE) reform was enacted in 1995 [27]. By 2000, the national formal education system was providing instruction in kindergarten (the Preparatory Year) and Grades 1 and 2 (Elementary 1 and 2) in 380 national languages [27]. With the number of vernacular languages reportedly used in the first three years of formal education exceeding 430 by 2003, VE reform was viewed by UNESCO as an unqualified success, particularly because it allayed the "widespread popular fears that English-only education was alienating children from their cultures and

communities, and failing to prepare them to live and be active in their communities after schooling" [27].

With the rapid integration of PNG into the world economy, popular perceptions and expectations of what constitutes quality education, as well as the needs and demands of the national economy have also changed. Shortage of indigenous expertise in science and technology became an issue of government concern in PNG, prompting a major policy shift from Vernacular Education (VE) to Tuition Fee Free (TFF) Universal Basic Education (UBE) [28]. Designed to raise literacy levels and quality of education in the country, these policies gave hope to millions of Papua New Guineans who flooded the nation's classrooms with the desire to learn.

There is now better ACCESS to basic education, and higher RETENTION of students enrolled; however, the QUALITY index is still "low and steadily declining" [29]. Numerous descriptive studies have been conducted to assess the seriousness of the situation; "reports of national committees have been produced by commissions, external consultants, missions, workshops and seminars" [30]. Yet, few attempts to analyze the *causes* of this decline have been made in the context of the prevailing international opinion on the value of Mother Tongue (MT) use in the first three years of formal schooling.

The UBE policy, introduced in 2013, is largely viewed as a step backward by Summer Institute of Linguistics (SIL) [21, 31 - 33] and international education consultants and agencies, including UNESCO.

Notwithstanding, there has been a profound shift in public opinion and parental expectations regarding the value of English in formal education, and questions started being asked about the effect of the delayed exposure to English (mandated by VE) on students' academic performance in secondary and tertiary education. Several studies, conducted by the Linguistics Department, School of Humanities and Social Sciences (SHSS) University of Papua New Guinea (UPNG) have established a significant inverse correlation between the Age of Onset (AO) of English learning and the academic performance of students in the six National High Schools (NHSs) of PNG [34 – 36]. A recent study, conducted at the UPNG in 2015, reported statistically significant relationship between UPNG students' Early Learning Language (ELL) backgrounds and their Grade Point Averages (GPAs) [37]. The authors suggested that a more detailed study should be carried out to reassess their findings.

The aim of the present study was to measure the influence of three factors in the linguistic backgrounds of students in the School of Humanities and Social Sciences (SHSS)

University of Papua New Guinea (UPNG) – the students' Age of Onset (AO) of English learning, their Age at Literacy (AGELIT), and their Early Learning Language (ELL) – on their academic performance, measured by the students' GPAs for the First Semester of the 2017 academic session.

Our main objective was to explore the possible causes of falling academic standards in SHSS UPNG and, thus, to help remedy the situation.

METHODOLOGY:

This study was carried out in the SHSS UPNG during the Second Semester of the 2017 academic session. A purposive cross-sectional sampling method was used for the selection of students. All the 966 full-time registered students in the SHSS during the 2017 academic session were eligible to participate in the study.

A self-designed pretested questionnaire, consisting of nine short questions was used to collect data on SHSS students' language education backgrounds, including their Age of Onset (AO) of learning English, Age at Literacy (AGELIT) and Early Learning Language (ELL).

The questions were as follows: *Your name and student Identification number (ID#)? Your gender? Your year of study? Your major in*

SHSS program? What was your first language spoken at home? How old where you when you learned to read and write? At what age did you learn English? In which Province did you learn to read and write? In what language did you learn to read and write? (Please tick the appropriate box: Vernacular-only, Tok Pisin mostly; English mostly).

Students' language education details were entered into Excel spreadsheets, coded, and matched with the respective students' GPAs for Semester 1, 2017, forming our final dataset. All data were then entered into SPSS Version 20 for Windows.

The continuous AO and AGELIT variables were separately transformed into three groups each (Early, Normal and Late). Descriptive statistics, comparison of means, correlation, linear regression, and nonparametric analyses were performed, as appropriate.

RESULTS:

Of the 966 questionnaires distributed, 507 (52.5%) were completed and returned. The 47.5% (459/966) non response rate was due to time constraints for data collection, as well as to logistical problems. The variables used for the statistical analysis of the data are presented in Table 1.

Table 1: Description of variables used in the statistical analysis

	Variables		Age (years)	Number of students (%)
1	AO		1 – 15	
2	AO groups	Early	1 – 5	90 (17.7%)
		Normal	6 – 8	302 (59.6%)
		Late	9 – 15	115 (22.7%)
3	AGELIT groups	Early	4 – 5	89 (17.5%)
		Normal	6 – 8	303 (59.8%)
		Late	9 – 15	115 (22.7%)
4	ELL	English		338 (66.6%)
		Tok Pisin		120 (23.7%)
		Vernacular		34 (6.7%)
		TokPisin – Eng		14 (2.8%)
		Vernacular – Eng		1 (0.2%)
5	GPA	Mean GPA = 2.40		Highest GPA = 4.67 Lowest GPA = 0.25

The research questions and hypotheses were as follows:

Q 1: Does the AO of learning English affect SHSS students' academic performance?

1st H_0: AO has no effect on SHSS students' GPAs.

Q 2: Does SHSS students' AGELIT affect their academic performance?

2nd H_0: SHSS students' AGELIT has no effect on their GPAs.

Q 3: Does the ELL affect SHSS students' academic performance?

3rd H_0: ELL has no effect on SHSS students' GPAs.

Various statistical tests were performed; comparisons of means, ANOVA, correlation and linear regression analyses, with the aim of measuring the strength of association between each of the three predictors (AO, AGELIT and ELL) and the students' GPAs obtained during the first semester 2017 academic session. Non-parametric tests were run to verify the validity of the null hypotheses.

For ANOVAs, the continuous variables AO and AGELIT were transformed into three categories each:

The AO variable was transformed into 3 AO Groups (AOG): Early (AO: 1-5 years); Normal (AO: 6-8 years); and Late (AO: 9-15 years).

Of the 507 students, 90 (17.7%) were in the Early AO group, 302 (59.6%) in the Normal AO

group and 115 (22.7%) in the Late AO group (Table 1).

The AGELIT variable was also transformed into three AGELIT Groups: Early (4 – 5 years); Normal (6 – 8 years); and Late (9 – 15 years). AGELIT Group distribution amongst the 507 student responders is presented in Table 1.

For Linear regression analyses, the AO and AGELIT were used as continuous variables, in line with Vanhove's recommendations [14].

Table 1 also shows the distribution of the Early Learning Language (ELL). Out of 507 students, 338 (66.6%) had done their elementary schooling in English; 120 (23.7%) were taught in TokPisin; 34 (6.7%) were taught in Vernacular; 14 (2.8%) were taught in a mixture of English and TokPisin, and just one student (0.2%) had been taught in both Vernacular and English. The mean GPA for all the 507 students was 2.40, the highest was 4.67 and the lowest was 0.25.

Tests of 1st H_0 validity:
Comparison of Means
The mean GPA values for the AOG Early, AOG Normal and AOG Late were 3.00 ± 0.53, 2.52 ± 0.53, and 1.59 ± 0.45, respectively. The mean GPA for the AOG Late was significantly lower (p = 0.000) than that for the Early and Normal AO groups. The GPA for the Normal AO group was significantly lower (p <0.05) than that for the Early AO group.

Further analysis, using One-way ANOVA, was carried out to compare the mean GPA between the groups and within groups. The results attest to the statistically significant (p = 0.000) variance in the mean GPA values in AOG.

R Squared (0.428) and Eta Squared (0.455) values, the Measures of Association between AOG*GPA, show a medium effect size, indicative of a significant mean GPA variation between the AO Groups

Fig. 5 illustrates the decline in the mean GPAs between the Early, Normal, and Late AO Groups, pointing to a robust *causal* link between students' AO and their academic performance.

Thus, comparison of means and ANOVA showed a medium strength association (Eta Squared = 0 .455) between AOG and GPA variables, indicating a significant inverse correlation between the age when the students started learning English, and their academic performance at UPNG.
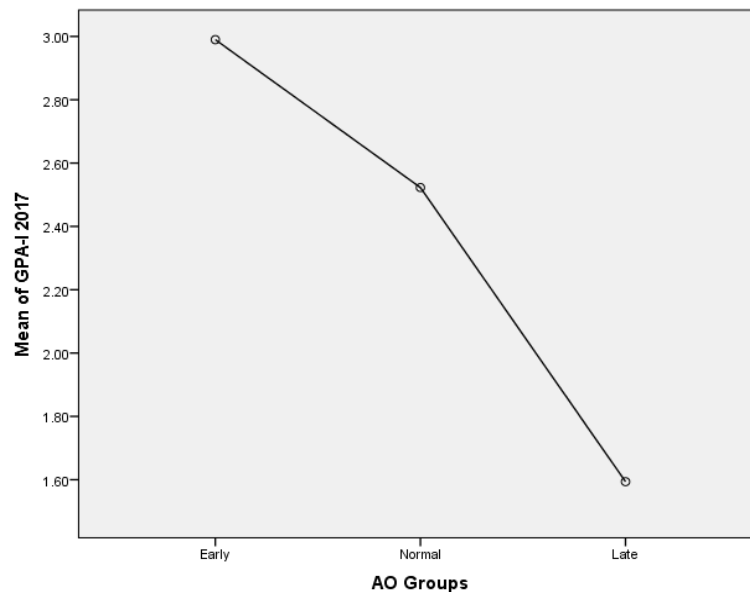
Fig. 5: Means Plot (one-way ANOVA). Age of Onset Groups GPA

Table 2. Coefficients [a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	3.608	.088		41.050	.000	3.436	3.781
	AO	-.168	.012	-.541	-14.448	.000	-.191	-.145

a. Dependent Variable: GPA-I 2017

Nonparametric analysis revealed a strong negative correlation (rho = – 0.683, p = 0.000, 2-tailed) between the AOG and GPA variables. The Pearson correlation analysis gave a similar result.

Linear Regression analysis corroborated these findings. The results show that AO had a statistically significant effect size (R Square = 0.292, adjusted R square = 0.291) on students' GPAs.

An increase in AO reduces the English score, as shown in Table 2.

In terms of elasticity, an increase in AO by one year results in 1.68 % decrease in students' GPA (p=0.000).

Nonparametric Tests of 1st H_0 Validity:

Since the AOGs were of unequal sizes, nonparametric tests were carried out; they established highly significant (p = 0.0001) differences in GPA distribution across AOG categories.

Independent-Samples, Kruskal-Wallis test were used to test the null hypothesis, *"that the distribution of GPA is the same across categories of AO groups"*. The decision was to "Reject the null hypothesis", the significance was p = 0.000.

Thus, our 1st H_0: *"AO does not affect SHSS students' GPAs"* had to be rejected, and the alternate 1st H_1: *"AO significantly affects SHSS students' GPAs"* was accepted.

Tests of 2nd H_0 validity:

The mean GPA for the AGELIT Early, Normal and Late groups were 3.10 ± 0.51, 2.52 ± 0.58, and 1.86 ± 0.63, respectively. The mean GPA for the AGELIT Late was significantly lower (p = 0.000) than that for the Early and Normal AGELIT groups. The GPA for the Normal AGELIT group was also significantly lower (p <0.05) than that for the Early AGELIT group.

Further analysis using One-way ANOVA was carried out to compare the mean GPA between the groups and within groups.

The mean GPA for AGELIT Early, AGELIT Normal, and AGELIT Late Groups fell steadily

from 3.09, to 2.52, and to 1.86, respectively. The effect size (Eta Squared = 0.279) of AGELIT on GPA between the groups is statistically significant (p = 0.000).

Comparison of means and ANOVAs showed considerable strength of association (Eta Squared = .279) between AGELIT and GPA variables, indicating a significant inverse correlation between the students' age at literacy and their academic performance at SHSS UPNG.

Nonparametric analysis revealed a strong negative correlation (rho = – 0.533, p = 0.000, 2-tailed) between AGELIT and GPA variables. The Pearson correlation analysis gave a similar result. These findings were corroborated by Linear Regression analysis. The results show that AGELIT had a statistically significant effect size (R Square = 0.278, adjusted R square = 0.276) on students' GPAs.

An increase in AGELIT was found to reduce the GPA score. In terms of elasticity, an increase in AGELIT by one year results in a 0.63% decrease in students' GPA (p = 0.000).

Nonparametric Tests of 2nd H_0

Independent-Samples, Kruskal-Wallis test were used to test our second null hypothesis, that: *"the distribution of GPA is the same across all categories of AGELIT groups"*. The decision

was to "*Reject the null hypothesis*", the significance was p = 0.000.

Therefore, we had to reject our $2H_0$ (that AGELIT does not affect SHSS UPNG students'

GPAs), and accept the alternate 2nd H_1: "AGELIT significantly affects SHSS students' academic performance."
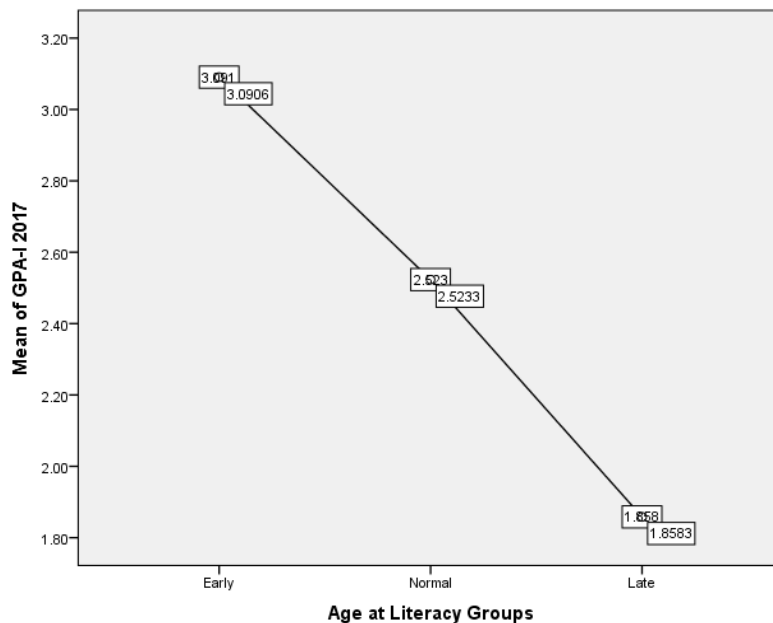
Fig. 6: Means Plot (one-way ANOVA). AGELIT Groups * GPA

Table 3: Mean GPA scores for Early Learning Language (ELL)

ELL	Mean GPA	Std. Deviation	N (%)
English	**2.52**	0.68	338 (66.7)
TokPisin	**1.99**	0.63	120 (23.7)
Vernacular	2.32	0.49	34 (6.7)
TP-Eng	2.98	0.51	14 (2.8)
V-Eng	2.50		1 (0.2)

Tests of 3rd H_0 validity:

The mean GPA for ELL English (2.52 ± 0.68) is higher than that for the other ELLs, except for ELL TP-Eng (2.98 ± 0.51). Since there were

only 14 students in the TP-Eng category, however, this result is not statistically significant (Table 3). The Eta squared value was 0.124.

The ELL distribution in Table 1 shows that 66.6% (338/507) of the students that participated in the study reported English as their ELL. This, in itself, is an index of higher academic achievement by students who had been taught literacy in English during the time of predominantly Vernacular Education. ELL English students' mean GPA was 2.52 ± 0.68 compared to GPA of 1.99 ± 0.63 for those with ELL Tok Pisin (Table 2). GPA values for the relatively few students with ELL Vernacular, ELL Tok Pisin + English, and Ell Vernacular + English were not statistically significant, because of their small population sizes.

The GPA results indicate that SHSS students with ELL English outperform those with ELL Tok Pisin. It also shows that students with ELL Vernacular perform better than those with ELL Tok Pisin.

To verify these assumptions, and to measure the ELL effect on students' GPAs, a series of bivariate correlation analyses were carried out, examining the link between ELL English and GPAs, ELL Tok Pisin and GPAs, and ELL Vernacular and students' GPAs. For that purpose, the categorical variable ELL was transformed into five independent variables (Table 1). Three of them were further analysed: ELL English, ELL TokPisin, and ELL Vernacular. The Spearman's rho correlation of coefficient shows statistically significant linear correlation (rho = 0.318, p = 0.000, 2-tailed) between the GPA and ELL English. A statistically significant inverse correlation (rho = − 0.326, p = 0.000, 2-tailed) was shown between GPA and ELL TokPisin. A weak non-statistically significant inverse correlation (rho = − 0.028, p =0.532, 2-tailed) was shown between GPA and ELL Vernacular.

The contrast between ELL English and ELL TP is evident; with Spearman's rho correlation coefficients of 0.318 and -0.326, respectively, these results show that students with ELL English do much better in the SHSS UPNG than those with ELL TP.

In order to rule out multi-collinearity issues, we first ran a series of collinearity diagnostic tests which established the absence of collinearity between the three predictors (ELL English, ELL TokPisin and ELL Vernacular). Linear Regression analyses, run to determine how each of the three independent variables (ELL English, ELL Tok Pisin, and ELL Vernacular) affected the students' GPAs, also corroborated the correlation results.

The Beta coefficients represent the rate of change in GPA as a function of each predictor ELL. Our results show that ELL English increased students' GPAs by 0.46%. Standardized coefficients Beta = 0.309, p = 0.000.

The ELL Tok Pisin decreased student's GPAs by 0.52%. Standardized coefficients Beta = −0.32, p = 0.000. This means that the GPA of students with ELL English backgrounds is likely to be higher than that of students with ELL Tok Pisin backgrounds by as much as 0.98%.

ELL Vernacular group size (N=34) was too small to produce statistically significant results. The low proportion (relatively small number) of SHSS students with ELL Vernacular backgrounds may be due to either poor implementation of the Vernacular Education policy, to a negative effect of using ELL Vernacular, or to both.

The Linear Regression results, therefore, indicate that ELL English benefits the students most, as it gives them those English skills they need in order to do well at all subsequent stages of their formal education.

Nonparametric Tests of 3rd H_0 validity:

The nonparametric tests of the 3rd H_0 validity corroborated our linear regression findings.

Independent-Samples, Kruskal-Wallis test were used to test our third null hypothesis, that: *"the distribution of GPA is the same across categories of ELL"*. The decision was to "*Reject the null hypothesis*"; the significance was p = 0.000.

Therefore, we had to reject the 3rd H_0 and accept the alternate 3rd H_1: That the distribution of GPAs is not the same across categories of ELL.

DISCUSSION:

The results of our data analysis, therefore, support the following broader conclusions:

AO has a significant inverse effect on SHSS students' GPAs:

English proficiency is a prerequisite for comprehension of course content in all academic subjects taught at Primary, Secondary, and Tertiary levels of education; consequently, AO is strongly linked to students' overall performance. The established inverse correlation between AO and SHSS UPNG students' GPAs suggests that the earlier the students began to learn English, the better they do at UPNG. Delayed exposure to English, mandated by the Vernacular Education policy, appears to have inhibited the students' general academic potential, ultimately reducing the quality of their education at all post-elementary levels.

UBE Syllabus 2015 offers only 1 hour of English learning a day (5 hours a week) in the 4 years of Elementary school [28]. This is insufficient for effective acquisition of English skills. Though the normal age for enrolment into Elementary school in PNG is six years, our results indicate that students will perform better, if they start learning English in pre-school, before the age of six. There is a strong link between students' AO and their GPAs;

therefore, the earlier students are taught English, the better.

AGELIT has a significant inverse effect on SHSS UPNG students' academic performance: There is a strong link between students' Age at Literacy (AGELIT) and their GPAs. English Literacy is the tool that students in Papua New Guinea must use at all post-elementary levels of education. The Age factor impacts all aspects of language education; if children are not taught to read and write in early childhood, their learning potential is likely to decrease. Therefore, students will benefit most, if they acquire English literacy skills in Elementary Prep or earlier, before they enrol into Primary school. Apart from potentially promoting learning among primary school pupils, this would also reduce the work burden of primary school teachers, and allow them to focus more on the actual content of the subjects they teach.

GPA distribution is not the same across categories of ELL:
The mere fact that 66% of all SHSS students had English ELL speaks for itself: the 'survival of the fittest' principle applies equally in education. The under-representation of ELL Vernacular students in the wake of the Vernacular Education 'era' is not less telling: only 7% of SHSS students in 2017 had ELL Vernacular backgrounds. This could be explained by the lack of qualified teachers and

teaching resources in Vernacular languages, as well as by the fact that many of the indigenous vernacular languages of Papua New Guinea are still exclusively oral. ELL Tok Pisin background students (24% of the school population) had the lowest GPAs; the reasons for this should be further investigated. It is clear, however, that students with English ELL perform significantly better than those with Tok Pisin ELL. Therefore, it seems equally clear that children should be taught to read and write in English, and not in Tok Pisin.

We are acutely aware of the complexity and interrelatedness of all the socio-economic and cultural factors impacting on the quality of education. Government action is required to ensure quality teacher training and adequate support of the teaching and learning processes in all schools. However, our findings have reliably established a causal link between three of many other interrelated factors (AO, AGELIT, ELL) and students' academic performance. Students will do better at all levels of education, if they acquire English skills in early childhood – the earlier, the better. Despite our stated support for bilingual education, these findings seem to contradict the current emphasis on MT education, stressed in most unequivocal terms in the recent UNESCO guidelines and recommendations [38]:
"UNESCO emphasizes the central role of mother tongue instruction in achieving quality

Education for All and affirms research demonstrating that use of L1 is crucial to effective learning in school. At the same time, UNESCO has a stated commitment to the use of "multilingual education" to support full participation in the regional, national, and global economies and social worlds. These position statements should not be misconstrued to mean that UNESCO accepts 'short cut' transition or transfer programmes into L2; rather, UNESCO advocates for the fundamental role of literacy and academic proficiency in L1 as the foundation of academic success in any language. UNESCO holds that children ought not to be compelled by language-in-education policies to sacrifice their right to develop L1 in favour of acquiring a majority language. 'Short cut' transition programmes tend to result in subtractive bilingualism. UNESCO works to raise awareness of the need to support children in becoming fully literate and highly proficient in their first language to create a foundation for the acquisition of additional language(s)" [38].

"Clarify the number of years required to become proficient in a language:

Creating a strong linguistic foundation typically requires at least six years of formal schooling in L1 as the medium of instruction. Current research calls for a revision of UNESCO's guideline of providing mother tongue instruction up to age 6 to 8 years, pointing instead to the need for mother tongue instruction up to primary year 6 or 8" [38].

Most research in MT/Vernacular education has been descriptive, however; we have not come across any other study, conducted in PNG or elsewhere, with similar aims, objective and design; therefore, it is difficult to compare our findings with literature that informs UNESCO educational guidelines.

CONCLUSIONS:

The results in the present study have produced concrete and unequivocal evidence of a strong causal link between three predictor variables (the age at which those SHSS students that participated in this study had started learning English (AO); the age at which they learned to read and write (AGELIT); and ELL, the language of instruction in their elementary schools) and the dependent variable, the students' Semester 1, 2017 GPAs (these provide an objective measure of their overall academic performance). Our findings show that students' academic performance is likely to be higher, if they start learning English and acquire English literacy skills at a younger age (English is the language of instruction in all schools, colleges and universities in Papua New Guinea).

The Universal Basic Education (UBE) Elementary English syllabus 2015 [39] offers 1 hour of English learning a day (5 hours per week) in elementary school. This is certainly not enough for children to acquire the English skills they need at later stages of formal education. Compounded by the consequences of inadequate teacher education, the lack of focus on teaching English from Elementary Prep onwards results in students' low academic performance at primary, secondary, and tertiary levels of education. For too long, language

education policy in developing multilingual societies has been influenced by Appeal to Emotion (i.e., language is "the shrine of a people's soul" [40]). In the face of complex new socio-economic realities, it is high time that education policy be informed by our deepened understanding of brain development, and the effect of students' AO of SLA on their ability to obtain quality education.

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HAND HYGIENE AMONGST HEALTH WORKERS IN A TEACHING HOSPITAL: A STUDY OF KNOWLEDGE, ATTITUDE AND PRACTICES

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ABSTRACT

Though a relatively simple procedure, Hand Hygiene compliance rates tend to be highly variable and poor. This cross-sectional knowledge, attitude and practices (KAP) study was conducted at Shri Maharaja Hari Singh (SMHS) Hospital, a teaching hospital in Srinagar, India. The subjects that participated in this study included 106 nursing staff working in different departments of the Hospital. The Self-structured one plus WHO,s hand hygiene questionnaire for health care workers was used in this study. Almost 80% of the respondents skipped hand washing when in hurry. Only 12% and 28% used to hand wash before touching a patient and before doing simple procedures respectively. This study depicts the poor compliance of health workers regarding hand hygiene.

Key Words: Hand Hygiene, Infections, Health care facility
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INTRODUCTION

Every 1 in 20 hospitalised patients may be affected by Health Care associated infections (HAI) [1]. Most of the infections are spread via health care worker's hands and thus Hand Hygiene is the single most effective measure to prevent this spread. Though a relatively simple procedure, Hand Hygiene compliance rates tend to be highly variable and poor [2]. Hand Hygiene is a general term referring to any action of hand cleansing by using water & detergent and/or the use of alcohol-based hand sanitization for the removal of transient micro-

organisms from hands [3]. Annually, approximately 2.4 million deaths can be prevented by good hygiene practices, reliable sanitation & drinking water worldwide [4]. A Meta -analysis showed that improvements in hand washing reduced incidence of upper respiratory tract infections (URTI) and gastrointestinal illnesses by 21% and 31% respectively [5]. Though preventable with simple hand washing, Health Care Workers are reluctant to adopt recommended practices to curb the infection [6]. Lack of appropriate facilities, high staff to patient ratio, insufficient

knowledge and attitude of staff may be the reasons responsible for lack of compliance to hand washing [7].

In India, especially in Jammu and Kashmir (J & K) there is paucity of studies exploring this subject, although the prevalence of HAI is high in the whole of Asia [8], J & K being no exception. To improve Health Care Workers compliance with health Hygiene, it is therefore necessary to consider the hindering factors and attempt to improve them. With this background, this study was conducted to assess the level of knowledge, attitude and practices (KAP) among healthcare workers of SMHS hospital and thence to identify gaps and enhance good practices.

METHODOLOGY:

This cross-sectional KAP study was conducted at Shri Maharaja Hari Singh (SMHS) Hospital, a teaching hospital in Srinagar, India. Srinagar is the summer capital of Jammu & Kashmir state and SMHS hospital provides tertiary health care for residents of Srinagar as well as patients referred from other districts.

Study subjects were the nursing staff working in different departments. Convenience sampling was used to select the 106 subjects. Participant selection was purely voluntary. The purpose of study was fully explained to the participants and verbal consent was obtained. Confidentiality was ensured by avoiding use of names of participants.

The study was approved by the Institutional ethical committee. The investigator visited the participants in the hospital wards and explained the nature of the study. Thereafter questionnaire was administered. It was a self-structured one plus WHO,s hand hygiene questionnaire for health care workers. Knowledge and attitude were assessed using 11 and 8 questions respectively. For the assessment of practices there were 15 questions to assess practical activities performed by respondents. Demographic information was also collected. Data analysis was done using SPSS version software. Descriptive statistics was used to calculate percentages for each of the responses given.

RESULTS

A total of 106 Health workers participated in the study.40 (37.7%) were below 30 years of age and 66 (62.3%) were above 30 years of age. Of the 106 health workers 20 (18.9%) were males and 86 (81.1%) were females. When separated into age groups 4 of the 20 males were below 30 years of age and 16 were above 30 years of age; while 36 of the 86 females were below 30 years of age and 50 were above 30 years of age. Of the 106 participants 69 (65.1%) claimed to have received training in hand hygiene.

Responses to questions on Knowledge regarding hand hygiene are in Table 1:

Fifty percent (53/106) of respondents believed that unclean hands of Health care workers are the main route of cross-transmission of infection between patients in a health facility; while none(0/106) believed that using the same apparatus for different patients like BP cuffs and thermometers, is a main route of cross transmission of infection between patients.91.5% (97/106) of respondents had knowledge that hand hygiene before touching a patient and immediately before aseptic procedure prevents transmission of germs to patient; while all believed that hand hygiene after touching a patient prevents transmission of germs to health worker. 73.6% (78/106) respondents believed that hand washing and hand rub are to be performed in sequence ;while57.5%(61/106) respondents believed that hand rub is more effective and rapid than hand wash.43.4%(46/106) participants believed that 20 seconds is the minimum time required for Alcohol based hand rub to kill most of the germs on your hand. 60.4% (64/106) believed that hand rub should be used before abdominal palpation. 20.6% (22/106) had knowledge that no hand hygiene method is to be used before abdominal palpation. 72.6% (77/106) participants believed in washing hands after emptying bed pan and after making patient's bed. Likewise 64.2% (68/106) believed in washing hands with soap and water after

visible exposure to blood .Only 60.4%(64/106) had knowledge that damaged skin increases likelihood of colonization of hands with germs.42.4%(45/106) respondents were of the opinion that steps of hand washing are 4 and an equal percentage (42.4%) believed it to be 5.Only 7.5% (8/106) tick marked all the dirty areas of the hand mentioned in questionnaire.

Responses to the questions related to Attitude are presented in Table 2:

64.1 % (68/106) of respondents had a perception that they have sufficient knowledge about hand hygiene while 52.8% (56/106) believed that they practice correct hand hygiene all times. 79.2 % (84/106) respondents skipped hand washing when in hurry while 41.5% (44/106) reused gloves after removal.

Responses to the questions related to Practices and facilities available are presented in Table 3 and Table 4 respectively:

Only small percentage of 11.3%(12/106) and 26.4%(28/106) respectively used to hand wash before touching a patient and before doing simple procedures.88.6% (94/106) participants had facility for hand wash at their workplace and 80.1%(85/106) had gloves available. Motivation to hand washing in majority was fear of contracting infection while major barrier to hand washing was "forget to wash".

Table 1: Knowledge regarding Hand Hygiene (Note that not all the percentages are cumulative)

Questions	Variables	No (%)	
Main route of cross-transmission of infection between patients in a health care facility	a) Unclean –Hands of Health Care Workers	53(50.0)	
	b) Germs in the air within the hospital	32(30.2)	
	c) Patient's exposure to pathogens on beds, linen, floor etc.	21(19.8)	
	d) Using same apparatus for different patients like BP cuffs thermometers etc.	Nil	
Hand Hygiene: Actions prevent transmission of germs to the patient	a) Hand hygiene before touching a patient	97(91.5)	
	b) Hand hygiene immediately after a risk of body fluid exposure	94(88.7)	
	c) Hand Hygiene after exposure to immediate surroundings of patient	77(72.6)	
	d) Hand hygiene immediately before a aseptic procedure	97(91.5)	
Hand Hygiene: Actions which prevent transmission of germs to the Health care worker	a) Hand Hygiene after touching a patient.	106(100.0)	
	b) Hand hygiene immediately after a risk of body fluid exposure	100(94.3)	
	c) Hand Hygiene after exposure to immediate surroundings of patient.	80(75.5)	
	d) Hand Hygiene immediately before a clean/aseptic procedure.	80(75.5)	
Following statements on Alcohol-based hand rub are true?	a) Hand –rub is more rapid than Hand washing.	89(84.0)	
	b) Hand –rub causes more skin dryness.	70(66.0)	
	c) Hand-rub is more effective against germs.	61(57.5)	
	d) Hand-washing and Hand–rub are recommended to be performed in sequence	78(73.6)	
Minimum time needed for Alcohol-based Hand rub to kill most germs on your hand?	a) 3 seconds	13(12.26)	
	b) 10 sec.	13(12.26)	
	c) 20 sec.	46(43.39)	
	d) 1 minute	34(32.07)	
		Hand wash	Hand Rub
Which type of hand hygiene method is required in following situations?	a) Before Abdominal Palpation.	20(18)	64(60.37)
	b) Before giving an injection	53(50)	49(46.22)
	c) After emptying a bed pan	77(72.64)	25(23.58)
	d)After removing gloves	56(52.83)	45(42.45)
	e)After making patient's bed	77(72.64)	28(26.41)
	f)After visible exposure to blood	68(64.2)	36(33.96)
Following are associated with increased likelihood of colonization of hands with germs?	a) Wearing Jewellery (rings, bangles)	85(80)	
	b) Using artificial Finger nails	97(91.50)	
	c) Damaged skin	64(60.37)	
	d) Regular use of hand cream	36(33.96)	
Number of steps of hand washing	a) 2	3(2.83)	
	b) 3	13(12.25)	
	c) 4	45(42.30)	
	d) 5	45(42.30)	
Dirty areas of hand are: palm, fingers, finger tips, dorsum of hands, nails, web spaces (Tick your choice)	Those that correctly tick marked all the correct areas	8 (7.5)	
Hand Hygiene recommended	a) Before Medical Examination	84(79.24)	
	b)Before taking blood sample with gloved hands	73(68.86)	
	c)After wound Dressing with gloved hands	84(79.24)	
	d)After shaking hands	89(83.96)	
	e)After touching linen/bedding of Patient	93(87.73)	

Table 2: Attitude towards hand washing

Variable	No. (%)
Have sufficient knowledge about hand hygiene	68(64.2)
Think you practice correct hand hygiene all times	56(52.8)
Skip hand washing often when you are in hurry or over burdened with work	84(79.2)
Think wearing sterile gloves reduces the need for hand washing	93(87.7)
Stress on hand washing , if someone skips it	68(64.2)
Feel bad if and when you skip hand washing	77(72.6)
Use same pair of gloves for care of more than 1 patient	48(45.3)
Re-use your gloves after removal	44(41.5)

Table 3: Practices of health workers: N (%)

Practices	Always	Sometimes	Never
Frequency of Hand washing before touching the patient	12(11.3)	82(77.4)	12(11.3)
Frequency of Hand washing before simple procedures	28(26.4)	57(53.8)	21(19.8)
Frequency of Hand washing after touching the patient	40(37.7)	57(53.8)	9(8.5)
Frequency of Hand washing after simple procedures	32(30.2)	62(58.5)	12(11.3)
Frequency of Hand washing in a day's work	53(50.0)	53(50.0)	----
Frequency of Hand washing before meals or snacks	61(57.5)	40(37.7)	1(0.9)
Frequency of Hand washing after going to washroom	65(61.3)	28(26.4)	13(12.3)

Table 4: Facilities available & Practices of health workers N (%)

Facility for hand wash available at work place	94(88.7)		
Water & soap/ sanitizers available	85(80.2)		
Towel/ paper available for drying hands	37(34.6)		
Gloves available	85(80.2)		
Routinely use for hand hygiene	Soap and water 61(57.5)	Water alone 21(19.8)	Alcohol based hand rub 24(22.6)
Hand washing technique before meals and snacks	Soap and water 49(46.2)	Water alone 57(53.8)	Any other 0.0
Motivation to hand wash	Fear of contracting Infection 69(55.1)	Habitual 28 (26.4)	Dislike for filth 9(8.5)
Barriers to hand washing	Forget to wash 48 (45.3)	Lack of time 28(26.4)	Lack of soap & Water 30 (28.3)

DISCUSSION:

The results indicated that the participants in the present study had relatively good knowledge and attitude but poor practice of hand hygiene. Though majority recognised the importance of hand hygiene but practical compliance regarding the same was poor. The results also show that most of the respondents maintained hand hygiene but it was inadequately practiced. One of the main reasons for skipping hand hygiene was 'forget to wash' .Similar findings have been reported in other studies as well [9, 10]. Other barriers were lack of soap and water, and lack of time which are similar to the findings in other studies [9, 10]. The 'Forgetfulness' factor can be removed by regular sensitising of the hospital staff via displaying posters on walls in the hospitals. CME,s and trainings and retraining of the staff. Hospital authorities should ensure availability of facilities including water, soap, tissue papers and sanitizers for staff to use.

One of the main motivation factors for hand hygiene among the workers was fear of contracting infection. This is consistent with findings reported in other studies [11, 12]. The present study showed that 57.5% (61/106) of respondents washed hands before meals while 61.3% (65/106) washed hands after going to wash room. These results are higher than the 46.5% and 61.0% respectively reported by Abinye et al [13]. In our present study, only 34.6% (37/106) respondents had availability of

towel/paper for drying hands at their work places. This is despite the fact that hands drying are as important as hand washing in maintenance of hand hygiene. It is important therefore that hospital authorities provide these basic requirements for the staff to use. Our results regarding rates of hand washing with soap and water before interacting with patients was consistent with yet another study [13].

CONCLUSION

This study depicts the poor compliance of health workers regarding hand hygiene, emphasising the need for immediate adopting of such measures so that knowledge, attitude and practices of Health workers improve. A multi-pronged approach ,including keeping facilities available, regular trainings, reinforcement, education especially motivational programs need to be adopted and implemented in order to ensure strict hand hygiene compliance. More research is advocated to obtain more data that can be used to design interventions for improving compliance of hand hygiene in our hospitals..

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ASSESSMENT OF ADHERENCE TO THE NATIONAL POLICY ON MALARIA TEST, TREAT AND TRACK AMONG PUBLIC AND PRIVATE HEALTH FACILITIES IN ABUJA NIGERIA

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Running Title: Adherence to Malaria Test, Treat and Track Policy

ABSTRACT:

Several challenges relating to the diagnosis and treatment of malaria led to the World Health Organization's (WHO) new initiative of Test, Treat and Track (T3). This study assessed adherence to the National Policy on Malaria T3 by workers in public and private hospitals in Abuja in North central Nigeria. This descriptive comparative cross-sectional study was carried out among 380 health care workers (HCW) selected using multi-stage sampling techniques. Of the 380 HCW, 206 (54.2%) and 174 (45.8%) were from the public and private health facilities respectively. Research instrument used were semi structure, self-administered questionnaire. Data was analyzed using the SPSS software version 17 .0. Sixty eight percent (140/206) of respondents from public facilities were aware of the malaria T3 policy compared to 49.4% (86/174) from the private facilities (p<0.05). In addition, 33.0% (68/206) and 29.9% (52/174) of HCW in the public and private health facilities respectively had been trained on the policy. Mean composite knowledge score of T3 policy was 23.8% for public and 27.0% for private health facilities. Using mean adherence scores, 49.4% of public and 45.0% of private facilities had good adherence to the malaria T3; a null hypothesis of no difference in their level of adherence was rejected (p 0.066). Availability of national guidelines (OR 2.2, 95% CI 1.200-4.000, p 0.01) and having been trained (OR 1.5, 95% CI 0.800-2.700, p 0.220) were predictors of adherence on logistic regression. Good awareness, poor knowledge and poor practice of adherence to malaria T3 policy was concluded, with knowledge and practice being more in the public than the private health facilities. The training gap underscores the need for in-depth training of health staff holistic implementation of the malaria T3 policy in Nigeria.

KEY WORDS: Malaria T3 policy, Health care workers, Adherence, Nigeria
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INTRODUCTION

Malaria is a treatable and preventable mosquito borne illness that caused an estimated 655,000 deaths in 2010 mainly among children below 5 years of age in the sub Saharan African region [1]. In 2013, ninety seven countries had ongoing malaria transmission. About 3.3 billion people all over the world are at risk of having malaria. In areas mapped to be at high risk for malaria, more than one malaria cases occur per 1000 population [2]. Nigeria has yet, a long way to go in controlling malaria much more the elimination of malaria. Improving diagnosis and treatment of malaria will not only improve treatment outcomes, but it would also assist in rationalizing health care costs by reducing the consumption of anti-malarial drugs [3]. In addition, it could reduce the menace of drug resistance to anti-malarial medications [4,5]. In 2012, the WHO introduced a new highly ambitious initiative, to span malaria diagnosis, treatment and surveillance. This Test-Treat-Track malaria cases (T3 approach) [1-2] appeared to have given more attention to malaria control compared to previous years.

As the use of microscopy is very limited in most hospitals in sub-Saharan Africa worsened by poor electricity supply and poorly trained malaria microscopists, malaria rapid diagnostic tests (RDTs) are the suggested methods through which the confirmation of malaria diagnosis can be easily achieved. The accuracy, reliability and outcome of treatment based on results of approved RDT kits will therefore move Nigeria beyond the general belief that fever is malaria until proven otherwise. It would also serve as major determinant of adherence of health care workers to the implementation of the new guidelines or approach [4,5].

The trend and level of malaria testing most especially in the public health sector has greatly increased from less than 5% in 2000 to 45% in 2010 according to the World Health Organization (WHO) African Region [2]. "How come Nigeria has not reached the level of proposed global elimination of malaria like some other countries?" this is one of the interesting questions that urgently need the attention and focus of researchers. The aim of this study was to assess adherence to the national policy on malaria of Test, Treat and Track by health workers in public and private hospitals in Abuja, Nigeria.

SUBJECTS AND METHODS:

Study area

Abuja is the capital of Nigeria, and it is being administered by the Abuja Municipal Area Council. It has a total population of 2,440 200 according to the estimation in 2015 [6]. The average temperature is 30ºC, humidity of 62%, and wind of NW at 2km/hour and rainfall of 1400mm. Abuja experiences malaria transmission all year-round with peak transmission during the rainy season (March to

November). There are six area councils, numerous Primary Health Care centers, five General Hospitals and two Teaching Hospitals within the FCT.

The national policy on malaria was introduced in the FCT by the Federal Ministry of Health through the National Malaria Elimination Program Department in the 2014 [7]. The implementation package consisted of an on the job training of health workers concerning malaria case management and training on the change of policy through routine supervision and training.

Study design:

A comparative health facility based cross sectional descriptive study

Study populations:

The target population included all health workers in private and public health care facilities in Abuja, while those who took part in the study constituted the study population. Health workers who routinely diagnose and treat malaria in the health facilities and who have spent a minimum of one year at their duty stations were recruited into the study.

Sample Size:

This was determined using the modified Leslie Fishers formular $N= (Z_{\alpha/2} + Z_{\beta})^2[p_1(1-p_1) + p_2(1-p_2)] / (p_1-p_2)$ for calculation of sample size for multiple proportions [8], with p_1 and p_2 being the proportion of public and private health care worker's adherent to the T3 policy for malaria

which are 0.5 and 0.4 respectively [9,10]. A calculated sample size of 384 was increased to 400 to adjust for non-response

Sampling Technique

For this study, a multistage sampling technique was employed in selection of study participants. Abuja (under Abuja Municipal Area Council AMAC) is divided into three phases, Phase 1, Phase 2, and Phase 3; there are many districts under a phase. In stage 1, one district each was randomly selected by simple balloting technique from each of the three phases making a total of the three districts- Garki 1 District, City Centre District, and Gwarinpa District. In stage 2, the health care facilities were stratified into public and private by stratified sampling method using ownership of health facility as the stratifying factor. In stage 3, seven private and seven public healthcare facilities were selected by simple random sampling from each of the districts in AMAC. This gave a total of 42 healthcare facilities. In stage 4, all eligible consenting healthcare workers in the selected healthcare facilities on the day of data collection were purposively sampled.

Data Collection Instrument

The research instrument was a questionnaire and this was semi structured ,pretested and self-administered to study participants to obtain information on respondents` socio-demographic characteristics, awareness of T3

policy on malaria, availability of malaria RDTs (mRDT) and Arthemisin Combination Therapy (ACTs) in the past three months for diagnosis and treatment of malaria, knowledge of malaria diagnosis and treatment, testing before treating, use of ACT in health facilities and factors influencing adherence to the practice of T3 policy on malaria. Face and content validity of the instrument was done by review carried out by a T3 regional malaria programme officer. A psychometrician (expert on questionnaire construction) checked the questions for errors like double barreled confusing and leading questions.

Pre-testing of Instrument

A pilot study was done using 50 questionnaires distributed among health workers in Karu Nasarawa state with similar characteristics as study participants. Corrections were made and the instrument adjusted for the study.

Data Analysis

Data collected from the health workers was entered into the computer and analyzed using the SPSS 17.0 version, after data cleaning and ensuring data validity through random checks and double entry. Tables and charts were used to report descriptive findings. The mean and standard deviation was calculated for numerical data. Univariate analysis was carried out to calculate frequencies and proportions of the different socio demographic and other categorical variables. Bivariate analysis was carried out using Chi-squared test to determine the relationship between the main dependent variable (adherence to the national T3 policy on malaria) and some independent variables such as cadre, type of health facility, number of years of experience of health workers, training, knowledge, and availability of guidelines in the facility. P values of less than or equal to 0.05 was considered statistically significant. A binary logistic regression model was developed to determine the factors associated with adherence to the national T3 policy on malaria.

Data management: Major scoring has to do with knowledge and adherence to T3

Providers' knowledge and attitude on malaria case management: There were questions to assess the health workers knowledge of malaria case management in both private and public health facilities. Some of these questions include whether all fever equates malaria, questions were asked on the meaning of Test, Treat, and Track, whether all suspected malaria cases are tested before treatment and whether ACT was the drug of choice. The source of this data was as reported by the health care worker. Other questions were asked to assess knowledge and each scored maximum of 1 making a total of 5 (Table A). Scores of 0-2 was classified as Poor and scores of 3-5 as Good.

Table A: Questions:	Scores
Meaning of Test, Treat and Track	1
Every fever case is malaria	1
Malaria can easily be tested before treatment	1
Is MRDT used in the absence of fever	1
What is your drug of choice in treatment of malaria	1

Table B: Questions	Scores
Availability of mRDT in the past three months	1
Are all suspected cases referred to the lab for test?	1
Was testing done in the last case of suspected malaria seen?	1
Was result of test seen before commencing ACT?	1
Did you treat only malaria positive test results with ACT?	1
Drug of choice in treatment of last case seen	1
Was any feedback or follow-up done in the last case of malaria?	1
Is there any form of compulsion to treat malaria negative results?	1
Is there routine supervision on malaria?	1

Adherence to national T3 policy on malaria: this was measured by asking the health workers if they do testing for all suspected cases of malaria and results received before commencing antimalarial treatment. Follow up of patients` was also assessed. Other questions are shown in Table B:

There is a maximum of 9 score. Adherence was classified as Poor for scores 0-4 and Good for scores 5-9.

RESULTS:

Table 1 shows no comparable differences between the socio-demographic data of respondents in both types of health facilities. Sixty eight percent (140/206) of public and 49.4% (86/174) of private health facility workers were aware of the malaria T3 policy. In addition, 33.0% (68/206) of the public and 29.9% (52/174) of the private health workers had received training on malaria T3 policy. Figure 1 shows resource availability of T3 in

public and private facilities. About 51.5% (130/206) and 30.0% (51/174) of the respondents in the public and private facilities respectively have a copy of the national T3 guideline for the treatment of malaria in their facilities, while mRDT was available in the last 3 months in 81.5% (163/206) and 82.4% (140/174) of public and private health facilities respectively. Table 2 shows that the knowledge of T3 policy on malaria and this is generally poor in both types of facilities; with a good mean knowledge score of 23.8% (49/206) among public and 27.0% (47/174) among the private health facilities. Thus the mean good knowledge score was slightly higher in private than public facilities. In the public healthcare facilities, 49.4% (102/206) of respondents adhered (having good mean adherence score) to the T3 policy on malaria while 45.0% (78/174) of the respondents in private healthcare facilities adhered (having good mean adherence score) to the T3 policy on malaria.

Table 3 shows the mean good T3 knowledge score of respondents in public and private health facilities cross tabulated by selected characteristics. There was statistically significant difference in the mean knowledge score of T3 policy on malaria between public and private health facilities when stratified by

training (p 0.001) and sex (p 0.001) as p-value was less than 0.05 in both. There was no significant difference in the mean knowledge score of T3 policy on malaria between public and private health facilities when respondents were stratified by designation and level of care (p>0.05).

The result in Table 4 shows statistically significant association between level of care, designation, having been trained and pattern of adherence to the T3 policy (P<0.05), while no such association exists between adherence pattern and awareness of the T3 policy, age, sex and types of health facilities (P>0.05). There was not enough evidence to accept the Null hypothesis that there was no difference in adherence to the policy on malaria T3 between public and private health facilities (p 0.04).

Table 5 shows that facilities with malaria T3 guidelines available were 2.2 times more likely to adhere to the malaria T3 policy compared to those who did not have adequate guidelines (OR 2.2, 95%CI 1.241-4.015, p 0.01) though this observation was found to be statistically significant. Likewise health facilities with trained respondents 1.5 times more likely to adhere to the malaria T3 policy compared to those who did not (OR 1.5, 95%CI 0.790-2.718, p 0.220) though these observations was found not to be statistically significant.

Table 1: Socio-demographic characteristics by type of facility

Characteristics	TYPE OF FACILITY	
	Public (%)	Private (%)
Male	72 (35.0)	63 (36.2)
Female	134 (65.0)	111 (63.8)
Age group		
20 – 29	70 (35.0)	56 (32.9)
30 – 39	68 (34.0)	88 (51.8)
40 – 49	42 (21.0)	23 (13.5)
50 – 59	20 (10.0)	3 (1.8)
Mean age (SD): 33.9±7.9 years		
Mean years of Experience: 8.0 ± 7.0		
Designation		
CHEW	94 (45.6)	2 (1.2)
Nurse/Midwife	59 (28.6)	75 (43.1)
Doctor	53 (25.7)	97 (55.8)
Awareness of T3 Malaria Policy		
Yes	140 (68.0)	86 (49.4)
No	66 (32.0)	88 (50.6)
Training on T3 Malaria Policy		
Yes	68 (33.0)	52 (29.9)
No	138 (67.0)	122 (70.1)
Level of care		
Primary	122 (59.2)	-
Secondary	77 (37.4)	141 (81.0)
Tertiary	7 (3.4)	33 (19.0)

Fig. 1: Test Treat and Track Resource availability by type of facility: Bar chart showing T3 malaria resource availability by type of facility
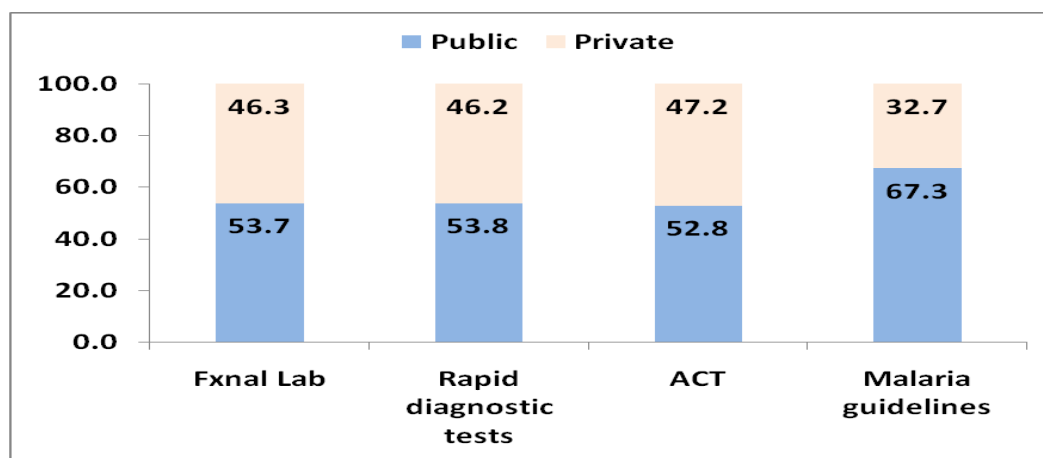
Table 2: Overall mean knowledge and adherence score by type of facilities

	Private		Pubic	
	Good	**Poor**	**Good**	**Poor**
Mean Knowledge scores	27.0	73.0	23.8	76.2
Mean adherence score	45.0	55.0	49.4	50.6

Table 3: Mean good knowledge score of respondents in public and private health facilities by selected characteristics

	Mean Good Knowledge Score		
Characteristics	**Public HF**	**Private HF**	**p-value**
Gender	23.8	27.0	0.36
Male	3.1	3.2	0.46
Female	2.7	3.2	0.00*
Designation			
CHEW	2.7	2.5	0.77
Nurse/Midwife	2.9	3.0	0.55
Doctor	3.2	3.4	0.31
Training on T3 malaria policy			
Yes	3.3	4.0	0.00*
No	2.6	2.8	0.04*
Level of care			
Primary	2.7	-	
Secondary	3.0	3.3	0.10
Tertiary	3.3	2.9	0.35

Table 4: Relationship between selected factors and adherence to test, treat, and track policy on malaria

Characteristics	Adherence T3		x2	p-value
	Good	Poor		
Awareness of T3 malaria policy				
Yes	179 (61.5)	50 (56.2)	0.81	0.37
No	112 (38.5)	39 (43.8)		
Training on T3 malaria policy				
Yes	98 (33.9)	21 (24.1)	2.51	0.08
No	191 (66.1)	66 (75.9)		
Level of care				
Primary	106 (36.8)	15 (17.2)	12.6	0.002
Secondary	151 (52.4)	63 (72.4)		
Tertiary	31 (10.8)	9 (10.3)		
Type of facility				
Public	155 (55.0)	43 (50.6)	0.34	0.55
Private	127 (45.0)	42 (49.4)		
Gender				
Male	104 (36.4)	29 (33.3)	0.15	0.7
Female	182 (63.4)	58 (66.7)		
Age (years)				
<34	161 (55.9)	47 (54.0)	0.03	0.9
≥ 34	127 (44.1)	40 (46.0)		
Years of experience				
< 8	186 (64.6)	56 (64.4)	0.01	1
≥ 8	102 (35.4)	31 (35.6)		
Designation				
CHEW	86 (30.0)	9 (10.3)	19.7	<0.001*
Nurse/Midwife	101 (35.2)	30 (34.5)		
Doctor	100 (34.8)	48 (55.2)		

Table 5: Binary logistic regression showing the relationship between selected factors and adherence to the T3 policy on malaria

Factors	Odds Ratio	95% Confidence Interval		p-value
		Lower	Upper	
Gender (M/F)	1.1	0.615	1.947	0.78
Years of Experience	1	0.940	1.021	0.33
Guidelines available (Yes/No)	2.2	1.241	4.015	0.01*
mRDT available in last 3 months	1	0.514	2.033	0.95
Type of health facility (Public/Private	0.6	0.355	1.683	0.15
Training (Yes/No)	1.5	0.790	2.718	0.22

DISCUSSION:

This study assessed adherence to the National Policy on Malaria T3 by workers in public and private hospitals in Abuja in North central Nigeria. The T3 policy recommends that every suspected malaria case should be tested, in other words malaria should be diagnosed either by microscopy or malaria RDT before treatment with Arthemisinin Combination Therapy as per in-country guidelines. All cases should however be tracked through timely and accurate reporting and surveillance system in order to forecast trends [1,2].

This study revealed that the public facilities (over two-thirds of the respondents) had a higher level of awareness to the T3 policy on malaria as compared to the private facilities (less than half of the respondents in). This pattern disagrees with a study done in 2016 in Ogun state, Nigeria [11] where awareness was found among almost all respondents in both types of facilities. More doctors having better awareness of T3 compared to other designation of HCWs in the present study was not unexpected, this could be due to the effect of the compulsory and regular continued medical education for doctors to enable them renew their practicing license.

Greater than two third of the respondents in the public (76.2%) and private (73.0%) health facilities have poor mean knowledge of the T3 policy on malaria and this disagrees with other studies [11-13] where over two thirds of the

respondents in each study had a good knowledge on the T3 policy on malaria. This may be attributed to the small proportion of the respondents that have been trained on malaria T3. Furthermore, awareness and training were not statistically significant factors associated with adherence to the T3 policy, in consistency with other studies showing that being trained does not necessarily translate into correct diagnostic and treatment practices [14-16].

This poor proportion of trained health care workers in this study agrees with other studies [17-19]. In another study conducted in Kenya, more (a little close to half) of respondents were found to be trained on malaria treatments [19]. This poor proportion of trained health workers in our study should be of concern to the government, other stakeholders and the health care facilities as this will have negative impact on the successful implementation of the T3 policy. The proportion of health workers in this study who have been trained on the T3 policy on malaria was very slightly higher in the public (33.0%) facilities than the private (29.9%) facilities unlike in the study done in Tanzania [20] where training was also poor in both public and private facilities but higher among health workers in the private settings in contrast to our own study.

As awareness may not necessarily translate into good knowledge, good knowledge may as well not guarantee good practice, in this case-adherence [21]. This appears practical in reality

because the health workers in both the public and private facilities may be trained on T3 policy on malaria but they will only work with the materials that are made available to them by their employers most especially in resource poor settings. Evidence from several studies have shown that well trained health care staff could do better in practice most especially in the presence of adequate number and quality of guidelines and job aids [21-23]. This trend however could not explain a finding from our study in which availability to treatment guidelines and the designation have statistical significance to the adherence to the T3 policy among health worker. It is therefore not surprising that those trained were 1.5 times more likely to adhere compared to those not trained on the malaria T3 policy. More than four-fifth of public and private health facilities studied reported regular availability of mRDT, and this finding is in contrast with a study done in Ogun state, Nigeria where only about one fifth of the private facilities had mRDT available and the public facilities had mRDT over four times the amount in the private facilities [11]. This regular availability of commodities is a good indicator to the successful implementation of the malaria T3 policy in Abuja. This may also not be unconnected with previous international collaboration on malaria such as the National malaria elimination program and huge support for malaria programming in the public sector most especially from NGOs and development partners. However, in health facilities where

commodities were reported not to be regularly available, health care workers in such facilities could sometimes be constrained to prescribe the anti-malarial drugs available in the facilities even if they are not prescribed in the guidelines. Thus the ability to regularly prescribe the recommended ACT would depend on the finding from this study in which availability of malaria T3 guidelines turned out to be a predictor of adherence, and health care workers in facilities where guidelines were available were 2.2 times more likely to adhere to the T3 policy compared to those without guidelines.

From this study, designation (being a Community Health Extension Worker CHEW), availability of guideline and level of care (Primary health facilities) were significant factors associated with adherence to the T3 policy while gender, number of years of experience, training and availability of mRDT were not. This agrees in part with other studies [11, 23] which showed that malaria training alone was not sufficient to ensure appropriate treatment. Other studies at public and mission facilities elsewhere in Africa have mixed results on prescribing practices of anti-malarial drugs as can be seen in some studies [19,24], though not in some other studies (25, 26). Therefore it can be concluded that respondents in this study had good awareness, poor knowledge but poor practice of adherence to malaria T3 policy. However, good knowledge and practices was higher among private than public

health facility care workers. The training gap underscores a dire need for in-depth training of staff in both public and private health facilities on holistic implementation of the malaria T3 policy in Abuja in North central Nigeria.

Conflict of interest: None to declare within or between authors or health resources related to this study

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TARGETING POSTPRANDIAL HYPERGLYCEMIA WITH FIXED DOSE COMBINATION OF REPAGLINIDE AND VOGLIBOSE IN TYPE 2 DIABETES MELLITUS

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ABSTRACT:

Present study evaluates efficacy and tolerability of fixed dose combination of Voglibose and Repaglinide in postprandial hyperglycemia (PPHG).A non-randomized, open labeled, non-comparative, multi-centric, study was conducted in 69 Type 2 diabetes mellitus (T2DM) patients, 53 (76.8%) men and 16 (23.2%) women. Each patient was administered a fixed dose combination of voglibose 0.3mg and repaglinide 1mg twice a day, just before each meal for 90 days. Fasting blood glucose (FBG) and postprandial blood glucose (PPBG) levels were measured at baseline (day zero), on day 30 and on day 90. Glycated Haemoglobin (HbA1c) was measured at baseline and on day 90. There was significant reduction in PPBG (31.2%), FBG (31.6%), and HbA1c (10.3%) on day 90 compared to baseline. Therefore fixed dose combination of voglibose 0.3mg and repaglinide 1mg has a considerable impact on PPBG control. This combination was found to be efficacious in controlling PPHG and no cases of hypoglycemia were reported.

Keywords: Diabetes mellitus; Voglibose; Repaglinide; FBG; PPBG; HbA1c.
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INTRODUCTION:

Globally, an estimated 422 million adults were living with diabetes in 2014, compared to 108 million in 1980. The global prevalence (age-standardized) of diabetes has nearly doubled since 1980, rising from 4.7% to 8.5% in the adult population. WHO projects that diabetes will be the seventh leading cause of death in 2030 [1]. Largest numbers of diabetic adults among the top 10 countries are in Asian subcontinent. China tops the list with 90 million followed by India which has 61.3 million persons affected by diabetes. The numbers are estimated to rise to 129.7 million and 101.2 million, respectively by 2030 [2].

Type 2 diabetes mellitus (T2DM), which comprise more than 95% of all the diabetic populations, has an insidious onset with a lengthy and latent asymptomatic phase [3, 4]. Prandial regulation of glucose is a multifarious process. The extent and time of the peak

plasma glucose (PG) depends on different type of factors, including the timing, amount and composition of the meal.

In healthy individuals, PG peaks about 60 minutes after the start of a meal, hardly ever exceeds 140 mg/dl, and returns to pre-prandial levels within 2 – 3 hours [5].

Post-prandial hyperglycemia (PPHG) appears to be the rate limiting factor for achieving optimal glycemic control in T2DM. In people with postprandial hyperglycemia, initial insulin release after food is decreased and there is fewer declines in glucagon secretion, resulting in improper glucose production in the liver leading to increased PPBG levels [6].

To accomplish optimal glycemic control, the consensus statement of the European Association for the Study of Diabetes (EASD) and American Diabetes Association (ADA) recommends a patient-centered approach to incorporate individual factors such as lifestyle, cost, motivation, and need to lose weight [7]. Further, the latest guidelines from the International Diabetes Federation recognize the importance of PPBG control in mitigating cardiovascular risks and include strategies for cardiovascular risk reduction as a major focus of therapy [8].

Drugs targeting post-meal hyperglycemia are essential to control the post prandial glucose level. These drugs may be used in combination

or as a mono-therapy. Combinations that specifically target PPBG can prove to be a beneficial approach in the management of PPHG.

This study was designed to investigate effectiveness and safety of fixed dose combination of Voglibose and Repaglinide (Prandin) in controlling PPHG in patients with type 2 DM.

METHODOLOGY:

Design and participants

This was a non-randomized, open labeled, non-comparative, multi-centric study to determine the effectiveness and safety of the fixed dose combination of voglibose 0.3mg and repaglinide 1mg twice daily for 90 days. A total of 69 T2DM patients, made up of 53 (76.8%) men and 16 (23.2%) women. The combined mean Age of all the patients was 55.1 ± 1.4 years and their age range was 26 to 81 years. All of them reporting to diabetologist, were screened for FBG and PPBG at baseline (day zero) and those fulfilling the criteria of FBG ≥126 mg/dl (7.0mmol/L) and/or PPBG ≥200 mg/dl (11.1mmol/L) were enrolled in the study. The study was conducted, at outpatient departments of diabetologists in Telangana, Malda and Thiruvananthapuram in India.

Patient characteristics:

Inclusion and Exclusion criteria

Informed consent in the vernacular language was obtained from each of the 69 patients with T2DM included in this study. Eligible patients were already diagnosed to have diabetes (T2DM) assessed as per FBG and PPBG were enrolled. The exclusion criteria included patients with any of the several conditions listed as follows: Subjects with planned surgery during the treatment course or undergone surgery prior to 3 months of enrollment. Patients with Type-1 diabetes, female type-2 diabetes patients who were pregnant or planning to conceive and lactating mothers were excluded from the study.

Assay of glucose and HbA1c:

The level of glucose in blood was assayed by the Glucose Oxidase Peroxidase (GOD-POD) method [9]. The HbA1c level in blood was assayed using the HPLC Biorad Variant II Turbo, National Glycohemoglobin Standardization Program (NGSP) certified [10].

Ethical clearance:

This was a post marketing surveillance study for already marketed formulation of the fixed dose combination of Voglibose & Repaglinide, hence only consent was taken from the patients for sharing their personal details and blood sugar reports.

Statistical Analysis:

All results were expressed as mean ± SEM. Statistical Analysis was assessed using Graph Pad prism 6 and $P < 0.05$ was considered as statistically significant.

RESULTS:

At the end of day 90, data was available for all 69 patients. At day 90 PPBG level was 165.7 ± 2.9 mg/dl; and day 30 level was (188.0 ± 5.864 mg/dl), both were significantly ($P < 0.0001$) lower compared to glucose level at baseline (240.7 ± 7.586 mg/dl) (Figure 1).

Percent (%) reduction in PPBG, FBG and HbA1c from baseline to day 30 and day 90 was statistically significant (Figure 2).

Similar trend was also seen with FBG which was significantly ($P < 0.0001$) reduced from baseline 158.0 ± 5.3 mg/dl to 129.2 ± 3.6 mg/dl at day 30 and 108.1 ± 2.5 mg/dl at day 90 (Figure 3). At the same time HbA1c after day 90 was 7.1 ± 0.13% when compared with 8.0 ± 0.17% at baseline ($P < 0.0001$) (Figure 4).

On 90th day there was no significant change in body weight compared to baseline. In the present study no adverse events including hypoglycemia were reported.

Figure 1: Mean Postprandial blood glucose level (PPBG) (mg/dl) at baseline, at day 30 and at day 90
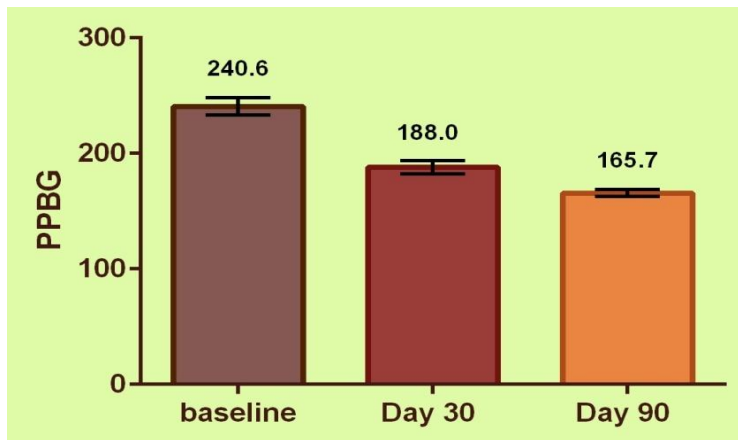
NB: Divide mg/dl by 18.01 to convert to mmol/L

Figure 2: Percent (%) Reduction in PPBG, FBG and HbA1c from baseline
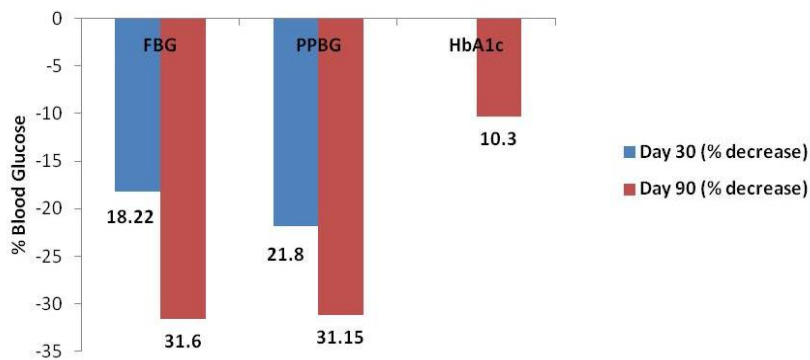
Figure 3: Mean fasting blood glucose levels (FBG) (mg/dl) at baseline, at day 30 and at day 90
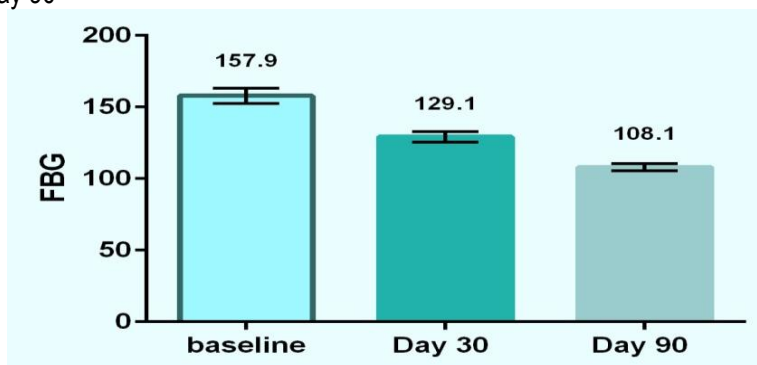
Figure 4: Mean change in percent HbA1c level from baseline to day 90
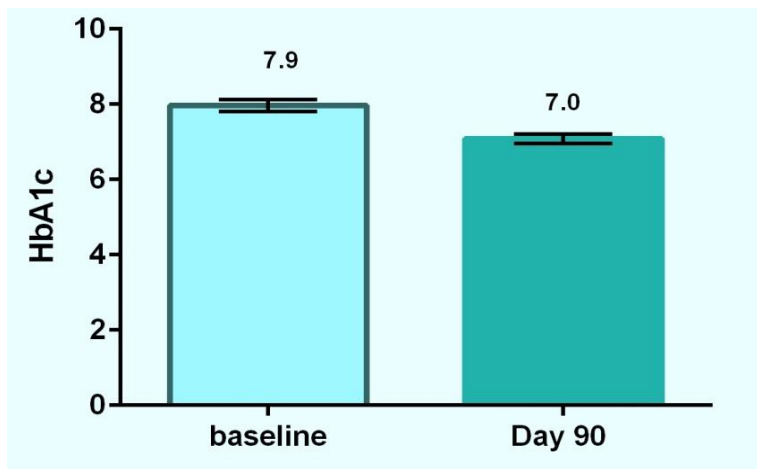
DISCUSSION:

In the present study effectiveness and safety of fixed dose combination of repaglinide and voglibose was evaluated in 69 T2DM patients. Voglibose is an alpha-Glucosidase inhibitor that delays the absorption as well as digestion of dietary polysaccharides by reversibly inhibiting carbohydrate digestive enzymes like sucrase, maltase, zomaltase; resulting in reduction in PPBG level [11]. At the same time Repaglinide mimics the physiological release of insulin and thus ameliorates PPBG [12].

When voglibose 0.3mg and repaglinide 1mg was combined and administered twice daily for 90 days there was significant reduction in PPBG at the end of 90 days which represents significant effect of combination therapy on PPBG control (Figures 1 and 2).

Fasting hyperglycemia is a phenomenon that has been observed in all individuals with diabetes and may be due to dysregulation of the normal circadian hormonal patterns resulting in increased hepatic glucose output. Normalization of the fasting blood glucose reduces the risk of the complications of diabetes [13].

In this study voglibose combination with repaglinide also has shown significant effect on FBG at the end of 90 days (Figure 3). PPBG contributes more to HbA1c levels than fasting hyperglycemia when HbA1c levels approach target values and, therefore, becomes the rate-limiting factor for achieving optimal glycemic control [14]. This can be interpreted as when PPBG is high or its control is poor it is more likely to get HbA1c above the recommended 6.5% In the present study, when compared to the baseline there was a statistically significant

reduction (P<0.0001) in %HbA1c at the end of 90 days study period (Figure 4).

CONCLUSION:

The fixed dose combination of Voglibose and Repaglinide showed statistically significant reduction in FBG, PPBG and HbA1c over 90 days compared to the baseline. No cases of hypoglycemia were reported during the study period.

ACKNOWLEDGMENTS:

Conflict of Interest: Author declares no conflict of interest.

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ABUSE AND NEGLECT OF MENTALLY ILL DESTITUTE AND THE BURDEN OF REHABILITATION IN BENIN METROPOLIS, SOUTHERN NIGERIA

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ABSTRACT:

The incidence and prevalence of mentally ill destitute in metropolitan Benin, Nigeria has become a subject of public discourse particularly as they appear to lack care and the desired attention from their relatives, society and the government. Apart from the Lunacy Act (1958), Nigeria currently does not have any Act of parliament dealing with mental health and rehabilitation. This study therefore examined the abuse and neglect of mentally ill destitute and the burden of rehabilitation in Benin Metropolis, Southern Nigeria. Though a onetime survey design, the quantitative technique was adopted with the aid of both purposive and snowballing sampling methods to gather data from 610 respondents made up of medical practitioners, nurses, staff of Ministry of Women Affairs, Benin City, care givers and social workers, personnel in traditional and prayer houses, relations, friends and neighbours of mentally ill persons in Benin Metropolis. Informed consent was individually obtained from all the respondents before the commencement of the study. The data collected were analysed with the aid of inferential and descriptive statistics and the three null hypotheses formulated were rejected while the alternate hypotheses were accepted. The study found that mentally ill destitute were not only abused and neglected due to prejudice, beliefs and attitude of the people, but that there were no social or legal policy on their rehabilitation. The findings indicate that enlightenment of the populace should be done to change their negative beliefs, attitude and prejudice against the mentally ill destitute. The government on its part should enact legislation on mental health and rehabilitation.

Key words: Vagrant psychotics, rehabilitation, abuse, neglect, stigmatization
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INTRODUCTION:

Nigeria is reported to be the most populous country in the continent of Africa with a population of approximately 196 million people (National Population Commission Annual Report, 2018). Statistics however revealed that about 20-30 percent of its population suffers from some kind of mental illness [17] and the

most worrisome is the fact that mental health services are grossly inadequate, leading to destitution. Interestingly, recent records reveal that the incidence and prevalence of mental health is on the increase [13] and quite unfortunately, Nigeria has failed to live up to the global treatments standards adopted by the world on mental health policy [18].

The concern over mental health of Nigerians predates even the pre colonial period as many mentally ill persons were left unattended to or at best, chained or locked up without medication, especially, as there were no mental health institutions then in Nigeria. However, during the colonial era in Nigeria, the British colonial masters burdened by this state of affairs and the need to provide adequate treatment and care for mentally ill persons, enacted the Lunacy Act [6]. Although, prior to the enactment of this Act, there was traditional mental health practice for treating persons with mental illness and destitution, the treatment was mainly limited to confinement, as those with mental illness were seen as dangerous, suspicious, irresponsible and homicidal [1]. Till date, no well-defined regulation of mental health exists, let alone welfare or rehabilitative provisions for mentally ill persons in Edo State, Nigeria. What exist at best are adhoc provisions [14]. This situation seems worsened because some citizens of the state see mental illness as caused by evil spirits and the gods.

This belief has in no small measure affected people's attitude towards the mentally ill destitute and their rehabilitation. There is therefore the need to investigate the abuse and neglect of the mentally ill destitute and their rehabilitation in Benin metropolis, Southern Nigeria.

Objective of the study:

The study investigated the abuse and neglect of the mentally ill destitute and the burden of rehabilitation in Benin metropolis, Southern Nigeria.

Hypothesis

Three hypotheses were generated for the study and these are: (1) There is no association between belief and attitude towards mentally ill destitute and their rehabilitation in Benin metropolis, Southern Nigeria. (2) There is no relationship between abuse and neglect of mentally ill destitute and their rehabilitation in Benin metropolis, Southern Nigeria. (3) There is no correlation between government social and health policy towards mentally ill destitutes and their rehabilitation in Benin metropolis, Southern Nigeria.

Conceptual issues: mental illness, destitute and rehabilitation

Mental illness is a medical concept covering a broad range of mental conditions-which imparts how a person feels, thinks, behaves and

interacts with others. McNailly [7] sees it as the disease of the brain which is complex and multifaceted. Destitute according to Alisiobi [27] refers to individuals who cannot cope with the demands of society and so are left without food, clothes, shelter and other basic necessities of life. A destitute is one without any means of subsistence; not having something; and poor enough to need help from others. A mentally ill destitute therefore refers to an individual with a mental condition that is down and out, not having any means of subsistence and is in fact, homeless. On the other hand, rehabilitation according to Odinaka [10] is a whole system approach to recovery from mental illness that maximizes an individual's quality of life and social inclusion by encouraging their skills, promoting independence and autonomy in order to give them hope for the future and leading to successful community living through appropriate support.

Nwaopara [9] noted that there is considerable statistics to show that persons with mental illness have limited access to real care and attention as would be desirable and mentally ill destitute are even more affected. Studies in Nigeria have shown that most mentally ill individuals are not cared for due to some reasons ranging from the harsh economic situation, as the lean resources available to the family is more often than not, directed at the

healthy members of the family due to the fact that severe mental illness may deplete the resources of even the most willing and stable families [5]. Worse still is that the mentally ill are often rejected, labeled and segregated against, even by their own relations, for fear of being dangerous and harmful. Benin metropolis still harbours the relics of ancient traditions, customs and beliefs and so derogatory words are still commonly used on the mentally ill, as they are branded with false and superstitious names [16, 1, 12, 11]. The result is lack of care and neglect, instead of rehabilitation. Presently, abuse, neglect and particularly discrimination is not well addressed in law, especially as there is no legislation on mental health in Nigeria. Although the constitution of Nigeria [3] prohibits discrimination, it however does not in clear terms identify health status as one of the grounds on which discrimination is prohibited.

This problem of human rights violation and stigmatization of the mentally ill persons/destitute was the concern of WHO [19] when it stated that mankind is besieged with human rights emergency in mental health because many countries do not have the basic legal framework to protect persons with a disability. Onyemlukwe [13] noted that the lack of a legal framework for protecting the human rights of people with mental disability in Nigeria is also emblematic of the gross neglect of mental disability.

Rehabilitation and treatment of mentally ill destitute

The concern over the abuse and neglect of mentally ill destitute over the years has given rise to interest in how they can be rehabilitated. In Benin metropolis, the mentally ill destitute are commonly treated and rehabilitated in traditional homes, prayer houses and in the mental health institutions presently available in Benin metropolis.

Trado-medical centres:

These centres are privately owned by traditional healers who claim to have powers to heal mentally ill persons no matter the degree of psychosis. As part of the healing process, they offer sacrifices to the gods as well as give herbs to these ill persons. Unfortunately, the healing process in these centres sometimes involve the confinement and chaining of the mentally ill persons while at other times, they are severely beaten , burnt and made to drink smelly concoction or substance [2]. Interestingly, the Edo State government through the Ministry of women affairs and social welfare seem to have given its nod to the existence of trado-medical practitioners' treatment and rehabilitation of mentally ill destitute in Benin metropolis as it from time to time gives grants to Omo-Oleabhiele traditional healing centre [14].

Christian prayer houses:

In Nigeria, there are several churches and Christian prayer houses, some of which are reputed for praying for the sick, potential immigrants to Europe and the mentally ill persons/destitute. They adopt various items in their spiritual warfare like the Holy bible, rosary, holy water, candles of all sizes and colours, incense, olive oil (anointing oil) and handkerchiefs [2].

The mental health institution:

Although there are several health institutions in Benin metropolis, the Federal Neuro-psychiatric hospital, Uselu, Mile 18 and Idunmwunwina are reputed centres for treatment and rehabilitation of mentally ill persons/destitute. The University of Benin teaching hospital also attends to mentally ill persons but the centre for mental health treatment and rehabilitation in Benin metropolis is the Federal Neuro-psychiatric hospital [14].

Theoretical explanation of mentally ill destitute and rehabilitation

In explaining the topic under study, the study adopted as its theoretical framework, the functionalist perspective. As a theory, functionalism essentially sees the society as a whole which is made up of different independent parts or units that work together for the smooth running of the whole system. The theory holds that a malfunctioning of any

part or unit of the whole, significantly affects the other parts even though they are supposed to be independent. This consequently leads to disequilibrium in the entire system. Proponents of functionalism as a theory argue that the society or system must always be or remain in a state of equilibrium which entails that all the parts or units must be functional [4, 15].

In relation to the topic under investigation, functionalism sees the health, political and family institutions as different independent units or parts of the society whose functionality ensures that the society is in a state of equilibrium. However and in line with the postulation of this theory, the malfunctioning in the political, health and economic institutions has caused disequilibrium in the functionality of the society. Specifically, the lack of political will on the part of successive governments at both the state and federal levels have impacted negatively on the mental health, rehabilitation and the health institution generally. Adequate funds are not made available to the few mental health institutions in Nigeria and so, the ability to effectively treat, care for and rehabilitate mentally ill persons has been most inadequate and epileptic.

The depressed Nigerian economy has on its part affected relatives and friends of mentally ill persons from actually caring for them. Most times, relatives tend to abandon them, due to lean finances.

METHODS AND SUBJECTS:

This is a cross-sectional descriptive research which was done in Benin metropolis, the capital of Edo state. Benin metropolis is located within latitude 60 14'N and 60 21'N of the equator and longitude 50 35'E and 50 44'E and covers approximately 1125 square kilometers.

It cuts across four local government areas: Oredo, Egor, Ikpoba-Okha and Ovia North-East. The 2006 population census puts the population of Benin metropolis at 1,085,676 million [8] and as at 2015, the National Population Commission annual report puts the figure at 1,496,000 million.

Primary and secondary data were used for the study with the primary data mainly sourced through the administration of structured questionnaires. A self designed 'Mentally ill Destitute Questionnaire' (MDQ) was employed to collect important information needed to achieve the objective of this study.

The questionnaire was made up of 28 questions which covered both the socio-economic characteristics of the respondents, abuse, neglect and rehabilitation of the mentally ill destitute. The reliability of the instrument administered on the respondents was determined through test-retest method while the validity was done through face validity by three resource persons in the University of Benin who are vast in the subject matter.

To complement the primary data collected, additional information were gotten from secondary sources which included; textbooks, journals, articles, seminar papers, news papers, magazines, official gazettes, official statistics and internet materials.

Due to the nature of the phenomenon under investigation, the purposive and snowballing sampling techniques were adopted to select respondents in the population that were interviewed. This consisted of a total of 610 respondents made up of medical practitioners, nurses, staff of Ministry of Women Affairs, Benin City, care givers and social workers, personnel in traditional and prayer houses, relations, friends and neighbours of mentally ill persons. Data obtained from the administered questionnaire were analysed using both descriptive and inferential statistics. Frequency count and percentage were employed to analyse the demographic data section of the research instrument while the chi-square statistics technique was used to test the three hypotheses generated for the study.

Based on the required ethical standards of studies involving human subjects, appropriate approvals or consents to be part of the sample population were obtained from all individual participants and their privacy was well protected. Respondents were before the commencement of the interview, briefed about the study and its expected outcomes or benefits.

RESULTS:

The results of the demographic characteristics of the respondents are presented in table 1. Of the 610 respondents, 68% (415/610) were male and 32% (195/610) were female. For marital status, 20% (120/160) were single, 75% (460/610) were married and 5% (30/160) were divorced. The distribution according to age group (120/610) is presented in table 1. On educational level, 34% (210/610) had post primary and 60% (365/610) had tertiary education. For their religion, 93% (568/610) were Christians, 2% (12/610) Muslims and 5% (30/610) practiced African Traditional Religion. For their occupation, 13% (80/610) were in private business, 57% (350/610) were health workers, 11% (65/610) were in social welfare and 19% (115/610) were unemployed.

Table 2 shows the result of the calculated chi-square from the observed data (0)- 467 respondents agreed that there is a significant relationship between belief and attitude towards mentally ill destitute and their rehabilitation in Benin metropolis while 143 disagreed. It is expected that, of the 610 respondents, (E) - 305 that is, half of the total respondents (610) were supposed to agree to the question asked while same number of

respondents should disagree. Therefore, we subtract the expected from the observed (0-E) and the result is squared (0-E)2 and then divided by the expected which sum gives 172.08 (the calculated chi-square).

Table 1: Demographic characteristics of respondents

	Frequency (%)
Gender	
Male	415 (68.0)
Female	195 (32.0)
Marital Status	
Single	120 (19.7)
Married	460 (75.4)
Divorced	30 (4.9)
Age range (yrs)	
14 - 26	60 (9.8)
27 - 36	280 (45.9)
37 - 46	150 (24.6)
47 - 56	85 (13.9)
56 and above	35 (5.7)
Educational level	
No formal education	10 (1.6)
Primary education	25 (4.1)
Post primary education	210 (34.4)
Higher education	365 (59.8)
Religion	
Christianity	568 (93.1)
Islam	12 (2.0)
ATR	30 (4.9)
Place of origin	
Indigenes	430 (70.5)
Non-indigenes	180 (29.5)
Occupation	
Private business	80 (13.1)
Health worker	350 (57.4)
Social welfare	65 (10.6)
Unemployed	115 (18.9)

Table 2: Relationship between belief and attitude towards mentally ill destitute and their rehabilitation in Benin metropolis

0	E	0- E	(0-E)²	(0- E)²
467	305	162	26 244	86.04
143	305	-162	26 244	86.04
610	**610**	**0**		**172.08**

Table 3: Relationship between abuse and neglect of mentally ill destitute and their rehabilitation in Benin metropolis

0	E	0-E	(0- E)²	(0- E)²
518	305	213	45369	148.75
92	305	-213	45369	45369
610	610	0		297. 50

Table 4: Relationship between government social and health policy towards mentally ill destitute and their rehabilitation in Benin metropolis, Southern Nigeria

0	E	0-E	(0- E)²	(0- E)²
430	305	125	16625	51/22
180	305	125	16625	51.22
610	610	0		102.44

Table 3 above indicates the result of the calculated chi-square from the observed data (O) -518 respondents agreed that there is a significant relationship between abuse and neglect of mentally ill destitute and their rehabilitation in Benin metropolis while 92 disagreed. It is expected (E) that, of the 610 respondents, 305 (50%) were supposed to agree to the question asked while same number of respondents should disagree. Therefore, we subtract the expected (E) from the observed (O) and then the result is squared (0-E)2 and then divided by the expected which sum gives 297.50 (the calculated chi-square).

Table 4 above indicates the result of the calculated chi-square from the observed data (O)-430 respondents agreed that there is a

relationship between government social and health policy towards mentally ill destitute and their rehabilitation in Benin metropolis, Southern Nigeria while 180 disagreed. It is expected (E) that, of the 610 respondents, 305 (50%) were supposed to agree to the question asked while same number of respondents should disagree. Therefore, we subtract the expected (E) from the observed (O) and then the result is squared (0-E)2 and then divided by the expected which sum gives 102.44 (the calculated chi-square).

DISCUSSION:

Considerable evidence in this current study indicate that, the calculative value stands as 172.08 and the critical value (table) 3.84, degree of freedom of 1 and significant level of 0.05. This indicates that the calculated value is higher than the table (critical) value hence; we reject the null hypothesis and accept the alternative hypothesis which states that there is an association between belief and attitude towards mentally ill destitute and their rehabilitation in Benin metropolis, Southern Nigeria. This finding is in tandem with Wahl [17], who found in his study that beliefs and attitudes of even the enlightened persons affect the way people handle, treat and relate with mentally ill persons or destitute.

Result obtained in the present study further indicates that, the calculative value stands as

297.50 and the critical value (table) 3.84, degree of freedom of 1 and significant level of 0.05. This indicates that the calculative value is higher than the table (critical) value hence; we reject the null hypothesis and accept the alternative hypothesis which states that there is a relationship between abuse and neglect of mentally ill destitute and their rehabilitation in Benin metropolis, Southern Nigeria. This current finding further lends credence to World Health Organization [17] and Ogundipe's [11] studies which revealed that mentally ill destitutes are not only discriminated against but are also abused in different ways ranging from physical to denial and violation of their rights in relation to rehabilitation.

Result obtained in the present study indicate that, the calculative value stands as 102.44 and the critical value (table) 3.84 degree of freedom of 1 and significant level of 0.05. This indicates that the calculated value is higher than the table (critical) value hence; we reject the null hypothesis and accept the alternative hypothesis which states that there is a correlation between government social and health policy towards mentally ill destitute and their rehabilitation in Benin metropolis, Southern Nigeria.

The finding of this study is further supported by the works of Nwaopara [9] and Onyemelukwe [13] where they noted that mentally ill

persons/destitutes do not receive the desired attention and care by society, especially, as there is no social or legal policy in relation to mental illness in Nigeria.

CONCLUSION:

Little or no research has been carried out specifically on mentally ill destitute and rehabilitation in Benin metropolis. The only visible concern of the Edo state government in relation to mentally ill destitute has always been to keep them off the streets through repeated evacuation and occasional grant to trado-medical practitioners. This effort is quite inadequate and might have helped in improving the wellbeing of these unfortunate vagrant psychotics if there were a social/mental health policy, not only in place but fully executed. Based on the findings of this study, there is the need to re-orient the populace in Benin metropolis not only on the need to change their negative beliefs and attitude towards mentally ill persons, but to desist from their unwanton abuse and neglect.

Efforts should be made to encourage relatives of mentally ill destitute to seek rehabilitation for them instead of abandonment. Since there is a relationship as indicated in the findings of this study, between government social and health policy towards mentally ill destitute and their rehabilitation in Benin metropolis, there is the need for government to enact a law or policy on mental health in Nigeria.

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USING PROTEINURIA AND URINE COLOUR INTENSITY IN THE DIAGNOSIS OF SCHISTOSOMIASIS IN RESOURCE LIMITED COMMUNITIES IN FEDERAL CAPITAL TERRITORY IN NIGERIA

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Running Title: Proteinuria and Urine Colour Intensity as diagnosis markers of Schistosomiasis

ABSTRACT:

Nigeria has the highest number of Schistosomiasis cases in the world, with significant gaps in epidemiological data to estimate the true magnitude of the problem. Haematuria (HU) and Proteinuria (PU) could be a low cost and valid indirect marker for screening of urinary Schistosomiasis instead of the standard urine filtration technique. This is particularly important in resource limited countries where microscopy related resources are not easily accessible. This study assessed the validity of Proteinuria and Urine Colour Intensity in the diagnosis of *Schistosomiasis* in the Federal Capital Territory (FCT) in Nigeria. A community based descriptive cross sectional study was carried out among 200 eligible school children selected using a multistage sampling method. Research instruments were semi structured interviewer administered questionnaire. Laboratory assays followed standard procedures. The mean age of the children was 11.0$\pm$3.7 years. The overall prevalence of *Schistosoma haematobium* infection by microscopy was 24.0% (48/200). Using proteinuria as an index of severity of infection, 59.0% (118/200) had no infection by virtue of a negative result, 15.5% (31/200) had mild, 11.5% (23/200) had moderate while 14.0 (28/200) had severe infection. There was a statistically significant association between the number of urine eggs and colour intensity (p=0.0001) and proteinuria (p= 0.001). Our results support the findings by others that HU and PU are simple indirect methods for identifying *S. haematobium* infection, and useful tools for the rapid mapping of the prevalence and community field screening for Schistosomiasis most especially in resource limited settings of Nigeria.

INTRODUCTION:

Schistosomiasisis is unique among common parasitic diseases causing morbidity and complications among individuals and communities. It is a chronic and debilitating disease caused by digenetic trematode flat worms of the genus *Schistosoma*. The species under the genus Schistosoma that causes human Schistosomiasis are *Schistosoma haematobium, Schistosoma intercalatum, Schistosoma japonicum, Schistosoma mansoni* and *Schistosoma mekongi* [1]. The disease affects more than 70 countries, mostly people from tropical countries in Africa, East Asia, and South America [2]. Despite the high burden of Schistosomiasis especially in Africa, which accounted for more than 85% of the estimated 238 million people infected with the disease in 2010 [3], Schistosomiasis is still therefore considered a neglected tropical disease.

The disease is endemic in tropical areas where there are currently millions of people living in areas with transmission risk [1]. A recent estimate from sub-Saharan Africa indicates that 280,000 mortalities yearly can be attributed to Schistosomiasis [4]. Schistosomiasis is associated with water resources development projects such as dams, irrigation schemes, rice and fish-farming, which seems to increase the human contact and thus increase the risk of infection [5]. Urinary Schistosomiasis caused by *S. haematobium* which results to passing of

eggs through the bladder wall causes damage leading to terminal haematuria, the passage of small amounts of blood and protein in to the urine [6]. Reagent strips can detect such small amounts of blood and protein present in urine and can thus be used as indicators of infection with *S. haematobium* especially in field surveys [7]. In resource limited countries where microscopy is not easily accessible, and where laboratory based human resources and availability of constant electricity for microscopy are limited, the detection of Haematuria (HU) and Proteinuria (PU) has been used as an indirect diagnostic assay for *S. haematobium* [8]. A study in Aliero Local Government Authority, Kebbi state in Nigeria reported high sensitivity and specificity figures for HU and PU in Northern Nigeria [9] However, the presence of blood in urine due to menstruation or presence of protein in urine due to urinary tract infections (UTI) and other pathologies are confounding issues with regards to reagent strip results [10].Thus using appropriate low cost scientific technology as one of the principle of Primary Health Care (PHC), the use of Urine colour intensity is also possible to be a valid proxy and an indirect marker for screening of urinary Schistosomiasis instead of the standard urine filtration technique which PHC centres in resources limited endemic settings of Nigeria could not do. This study therefore aims at determining the validity of Proteinuria and Urine Colour Intensity in the diagnosis of

Schistosomiasis in resource limited endemic settings of the Federal Capital Territory (FCT) in Nigeria.

SUBJECTS AND METHODS:

The study area was the Federal Capital Territory (FCT) of Nigeria, with a population of about 3 million from a 2016 projection of the 2006 national population census [11]. The average temperature is 30ºC, humidity of 62%, and wind of NW at 2km/hour and rainfall of 1400mm.There are five area councils in the FCT, 2 major rivers transcends the FCT as foci of transmission. Majority of communities affected were served mainly by PHCs though there are 5 General Hospitals and two Teaching Hospitals within the large urbanized areas of the FCT. This was a community based descriptive cross-sectional study.

The study population consists of school aged children 6 to 17 years whose parents consented to the study and who have not been given any form of Schistosomiasis treatment in the past one year.

The sample size was calculated using the modified Leslie Fisher's formula for the calculation of sample size for population greater than 10,000 [12] and a Nigerian national average prevalence rate of 13.0% [13]. A sample size of 173.8 was obtained, and this was rounded up to 200 to account for attrition.

Two of the five Local Government Areas LGAs in FCT were randomly selected using simple random sampling employing simple balloting. Kuje and Abaji LGAs were selected. In Stage 2, a list of communities per LGA with established foci and designated by the LGA health departments as endemic for Schistosomiasis was made. Two communities per LGA were selected by simple random sampling. In a community using the Kings palace as a center, two out of the many designated clusters were randomly selected, each having 25 questionnaires allocated to them to mark the end of Stage 3.

In Stage 4, a list of eligible children within a cluster was made and a systematic sampling of one in three children on the list was carried out until the allocated number of questionnaires was exhausted. In clusters where questionnaires were not exhausted, another cluster was chosen in the same community using simple random sampling.

A semi structured interviewer administered questionnaire was used to collect some bio data and other Schistosomiasisis related information from the respondents. Face and content validity of the instrument was done by review carried out by an epidemiologist. Three trained research assistants including two laboratory scientists were employed in data collection.

Sample Collection and Laboratory procedures: Mid-stream urinary samples were collected into sterile plain, wide mouthed universal bottles. Each bottle was labelled with the sample number of a participant. Colour intensity was assessed visually before centrifugation. Urine colour intensity was assessed visually before centrifugation and graded [14]. For urinalysis, urinary strip whose precision and accuracy had been previously tested were dipped into the urine samples and was read following the manufacturer's instruction.

For macroscopy, each urine sample was read macroscopically for consistency, appearance, colour, presence of blood and turbidity. For microscopy, the urine sample was centrifuged, the supernatant was decanted and its sediments were examined for *Schistosoma heamatobium* eggs. Proteinuria was graded using the chart on the leaflet supplied by the manufacturers while colour intensity was done with visually. The procedure was explained to all participants and informed consent questionnaire were given to generate information on their bio-data and other selected variables in the checklist. A written informed consent was obtained from each of the parents of the children.

Data collected from the respondents were entered into spreadsheet in the computer and analyzed using the SPSS 17.0 version, after data cleaning and ensuring data validity through random checks and double entry.

Tables and figures were used to report descriptive findings. The mean and standard deviation was calculated for numerical data. Univariate analysis was carried out to calculate frequencies and proportions of the different socio demographic and other categorical variables. Bi-variate analysis was carried out using Chi-squared test to determine the relationship between the main dependent variable and some independent variables of interest. Validity indices considered include sensitivity, specificity, positive and negative predictive indices as well s diagnostic accuracy. P values of less than or equal to 0.05 was considered statistically significant.

RESULTS:

A total of 200 children in the 6 to 17 years age group were enrolled for this study. The socio demographic information of the children is showed in Table 1. The respondents comprised of 80.5% (161/200) males and 19.5% (39/200) females. The mean age of all the respondents was 11.0±3.7 years. For their educational level, 67.0% (134/200) were in primary school. The parents of 55.0% (110/200) of the children were farmers, while 50.5% (/200) had lived in their respective communities for more than 5 years.

Three - quarter of the respondents was aware of the Schistosomiasis infection by symptom of terminal haematuria. Among the population studied, the overall prevalence of *Schistosoma haematobium* infection was 24.0% (48/200).

Using proteinuria as an index of severity of infection, Table 2 showed that 59.0% (118/200) had no infection by virtue of a negative result, 15.5% (31/200) showed mild, 11.5% (23/200) had moderate, while 14.0 (28/200) had severe infection. For validity of proteinuria in assessing diseases status in *S.heamatobium* diagnosis, its sensitivity was 51.3% and sensitivity 36.1% with 53.7% and 33.9% positive and negative predictive indices respectively as shown in Table 3. We initially proposed that colour intensity would have association with Scistosomiasis which was based on the premises that all cleared urine would not contain *Schistosoma haematobium* egg while the turbid samples would have eggs ranging from mild to severe. It was observed that amber colored urine had highest number of schistosoma eggs [14]. There was a significant association between colour intensity and urine eggs (p=0.0001), and proteinuria and urinary eggs (p= 0.001) as shown in Table 4.

Table 1: Socio demographic information of respondents (n = 200)

Demographic Information	Frequency (%)
Age (Mean age: 11.0 ± 3.7 years)	
6 – 9 years	19 (9.5)
10 – 13 years	151 (75.5)
14- 17 years	30 (15.0)
Gender	
Male	161 (80.5)
Female	39 (19.5)
Educational Level	
Pre-Primary	-
Primary 1-3	66 (33.0)
Primary 4-6	134 (67.0)
Secondary	-
No school at all	-
Duration of time lived in the community	
Less than 6 months	9 (4.5)
6 months – 1 year	9 (4.5)
1- 5 years	81 (40.5)
More than 5 years	101 (50.5)
Parent's occupation	
Farming	110 (55.0)
Fishing	8 (4.0)
Trading	42 (21.0)
Self-employed	26 (13.0)
Civil servants	14 (7.0)
Aware of Schistosomiasis	
Yes	150 (75.0)
No	27 (13.5)
Not sure	23 (11.5)

Table 2: Severity of infections of Schistosoma heamatobium by proteinuria (n = 200)

Variables	Frequency (%)
No infection (-)	118 (59.0)
Mild Infection (+)	31 (15.5)
Moderate Infection (++)	23 (11.5)
Severe infection (+++)	28 (14.0)

Table 3: Validity of proteinuria and diseases status in S.haematobium diagnosis

Proteinuria Test Result	Disease Status		Total
	Positive (+)	Negative (-)	
Positive (+)	44	38	82
Negative (-)	78	40	118
Total	122	78	200
Sensitivity	44/122	-	36.1%
Specificity	-	40/78	51.3%
Positive predictive value	44/82	-	53.7%
Negative Predictive value	-	40/118	33.9%

Table 4: Associations of haematuria by urine reagent strips, self-report, colour intensity and Microscopy for Schistosoma haematobium

		Urine Eggs					Test Statistics (ANOVA)	
		Trace	Mild	Moderate	Severe	Total	F test	P value
Color Intensity	Clear	0	0	0	0	0		
	Turbid	7	4	2	0	13		
	Amber	0	0	1	34	35	40.403	0.001
	Total	7	4	3	34	48		
Proteinuria	Trace	0	0	1	8	9		
	+	-	-	-	-	-		
	++	7	4	1	0	12	38.205	0.001
	+++	0	0	1	26	27		
	Total	7	4	3	34	48		

DISCUSSION:

This study revealed that the children in the studied communities were at risk of Schistosomiasis and the prevalence could be described as moderate. The high awareness of Schistosomiasis by symptoms among about 75% (150/200) of our respondents showed that the disease is well known by people in the community. This high awareness rate agreed with other published studies [15-17]. A high awareness could assist respondents to know more about the risk factors, mode of transmission and future preventive measures. It would also encourage the affected communities to take more proactive measures towards disease control.

The findings in this study showed the establishment of moderate *S. haematobium* infection in the study area based on the prevalence rate of 24%, which is higher than the Nigerian national average of 13% [13] but lower than the WHO range which considers 40% to be endemic or high (18). This result agrees with the result obtained by another study [19]. Moderate or low prevalence could mean that the communities have made some efforts in the past to increase herd immunity to Schistosomiasis. This could be in form of targeted or mass treatment of the community with drugs such as Praziquantel, or health education of at risk groups and environmental

modifications that could assist disease control and prevalence reduction.

The was significant association between urine eggs with colour intensity and proteinuria ,which showed that both haematuria (HU) and proteinuria (PU) can be used as indicators of infection with *S. haematobium* especially in field surveys, as already proposed and suggested by earlier community based studies [7,20-22]; they can provide a semi quantitative result. In Nigeria, Schistosomiasis is still a problem getting the attention of Governments and development partners. In endemic areas where most serving health facilities are primary health centres and where electricity supply is erratic, the use of the standard microscopy could be elusive thereby making the use of basic low costs technology in diagnosis inevitable. Nurses and Community Health workers can perform these procedures and interpret the results correctly thus preventing missed opportunity in case management.

While concluding that HU and PU were shown to be reliable as a proxy to the filtration methods in the diagnosis of Schistosomiasis, it is important to compare both HU and PU since their sensitivity and specificity values could differ considerably from one endemic area to another. Although HU and PU are considered to be of good and high value in community and field screening for Schistosomiasis, more

complex designed local studies are required in order to obtain more valid conclusion on the subject matter of validity of both HU and PU in the definitive diagnosis of Schistosomiasis. The high prevalence of 53.6% of proteinuria among those infected with Schistosomiasis in this study suggest a dire need for coordinated and urgent steps to control the disease and prevent complications due to loss of essential proteins. Prompt diagnosis and treatment can also prevent other complications such as chronic kidney diseases and formation of urinary strictures among males.

In conclusion, an association was confirmed between HU, PU and use of urinary egg in diagnosis of Schistosomiasis as reported by earlier studies [14, 23]. This study showed moderate specificity of urine strip in evaluating proteinuria in the detection of urinary Schistosomiasis. The prevalence of proteinuria was high among the children with Schistosomiasis infections; thus, HU and PU testing can be used as a simple indirect method for identifying S. *haematobium* infection in this community. It can also be a useful tool for the rapid mapping of the prevalence of Schistosomiasis to identify high risk areas.

Conflict of interest: None to declare

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CASE REPORT:

NEVUS FLAMMEUS: A RARE PRESENTATION WITH ORAL MANIFESTATION

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ABSTRACT:

Port-wine stain (PWS) is one of the vascular birthmarks. Port-wine stains are capillary vascular malformations, characterized by flat lesion with pink or red stain and may involve skin, soft tissue or bone. Port-wine stains on the face can be a cosmetic problem. Port-wine stain (PWS) is one of the vascular birthmarks. Port-wine stains are capillary vascular malformations, characterized by flat lesion with pink or red stain and may involve skin, soft tissue or bone. Port-wine stains on the face can be a cosmetic problem. Oral manifestations of PWS are common. Dentists often anticipate complications such as bleeding caused by the hyper-vascularity of the gingival and oral soft tissues, along with functional and cosmetic deformities from bony overgrowth involving the jaws and teeth. This article reports a case involving the oral and perioral structures in individuals with facial PWS.

Keywords: Port wine stain; Nevus flammeus; Sturge-Weber-Dimitri syndrome.
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INTRODUCTION:

Port-wine stain (PWS) is also known as nevus flammeus. These are congenital vascular lesions that have psychological and physiological implications for the patient [1]. PWS is a hamartomous capillary malformations; it is named because of the deep red hue that appears on the skin and mucus membrane[2].These birth marks occur in 0.3 percent of the live newborns and affecting females and males equally [3]. PWS are often located on the face usually unilateral and follows the course of the trigeminal nerve. It appears at birth as a diffuse light pink macula and tends to become darker and thicker with age. Unlike hemangiomas, PWS generally do not fade over time, and do not disappear; but may expand while the child is growing [4].

The port-wine nevus, localized especially over the right side on the face, is detected in 87 to 90% of the cases. Bilateral involvement can be detected in about 33% of the cases and

extension of the lesion over the middle line is observed in 50% of the patients [5].

PWS lesions are characterized histologically by ecstatic vessels and a deficiency of nerves in the papillary plexus of the skin in the affected area. These deficient nerves are of sympathetic origin, and that unchecked parasympathetic influence on blood flow through the post capillary venules results in progressive vascular ectasia [6]. Here we report the case of a male patient showing gingival changes with port-wine stain.

CASE REPORT:

A 22- year-old male reported to the dental clinic with complaints of decay in the lower teeth since 4 years. On examination diffused purple colour patch on the left side of the face was seen, extending about 3 cm below the hairline superiorly to the angle of the mouth inferiorly laterally from the left tragus, medially to the midline. Intraorally purple discolouration was observed on the mucosal aspect of upper lip, upper vestibule and gingival on the left side (Figure 1). The gingival tissue of the left upper jaw was reddish and darker than the right side with alveolar hypertrophy. The caries index was high involving almost all posterior teeth. No history of CNS disorders was reported by the patient. Patient did not have any complain about the non aesthetic facial view, and did not accept the treatment of his gingival pigmentation.

Figure 1. Intraoral view with gingival involvement on the left upper gingival region.

DISCUSSION:

Port wine stains are congenitally acquired; resulting from abnormal regulation of blood flow that leads to a progressive vascular dilation and the characteristic discolouration. These lesions are more commonly seen among Caucasians than African Americans and Asians. They usually begin as flat and pink, becoming thicker and darker over time. In advanced lesions, nodules or "cobblestones" may be present [7].

.In the head and neck region port wine stain usually follow the distribution of the branches of the trigeminal nerve. When the maxillary and/or mandibular divisions are involved, the bone and soft tissue of the oral cavity are often affected. This may result in complications such as bleeding caused by the hypervascularity of the gingival and oral soft tissues during dental procedures, along with functional and cosmetic deformities from bony overgrowth involving the jaws and teeth [8].Orodental manifestations includes staining of the oral soft tissues, hyperplasia of the gingiva, oral bleeding, overgrowth of the bony alveoli, and possible interruption in dental eruption sequence and lip enlargement [9].

Not all patients with facial PWS will have struge weber syndrome. Only the patients with involvement along the distribution of ocular branch of trigeminal nerve are at the risk for development of this condition [10].

Port-wine stains are associated with the following syndromes, Sturge-Weber-Dimitri syndrome characterized by noninherited and nonfamilial, port wine stain, leptomeningeal angiomas and Klippel-Trenaunay syndrome characterized by port wine stain, angiomatosis of the extremities [11].

Differential diagnosis for PWS includes nevus flammeus neonaturum pyogenic granuloma and venous varicosities [2].

Presence of port-wine stains on the face can be a cosmetic problem and usually cause deep psychological trauma to the patient and the development of personality is affected in almost all patients [12].Patients with port wine stains may experience feelings of stigmatization, embarrassments, anxiety and depression [1].

Treatment modalities for PWS include curettage, cryotherapy, dermabrasion, tattooing, chemical cauterization, electric cauterization, photodynamic therapy, intense pulsed light, spectrophotometric devices [3]. Pulsed tuneable dye laser (PDL) has become the treatment of choice. Laser therapy has been the most successful at eliminating port wine stains. It is the only method that can destroy the tiny blood vessels in the skin without significantly damaging the skin [13]. Port-wine stains can also be treated by a high dose of hydrocortisone given orally in infancy results in regression of well-localised small lesions [12].

A simple and effective technique for removal of gingival pigmentation is surgical excision of the epithelium and pigmented gingiva. Other

therapeutic approaches for treatment of gingival pigmentation such as cryosurgery, chemical abrasion, free gingival grafts, gingivectomy and laser. PWS involving gingiva does not require treatment, except for the aesthetics demands [3].

CONCLUSION:

Oral manifestations of PWS demands dentist's knowledge about this condition, associated syndrome, clinical features and treatment modalities. The consultations from various medical specialists are needed for proper treatment along with professional counselling for psychological benefit for the patient. Periodic systemic and oral examinations are recommended to prevent any cranial and oral complications.

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SHORT COMMUNICATION:

RAPID IMMUNOASSAY TECHNIQUE NOT SUFFICIENT FOR SCREENING OF PROSPECTIVE BLOOD DONORS FOR VIRAL HEPATITIS: A CASE STUDY IN OSUN STATE NIGERIA

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ABSTRACT:

Hepatitis B virus (HBV) is hyper endemic in Sub-Saharan Africa (SSA) and a major cause of chronic liver disease. Prior reports suggest a prevalence of 10.0% in the average risk Nigerian population. In Nigeria, investigators have found high HBV prevalence of 5.8% among voluntary blood donors. In the present study an evaluation of a rapid assay (RA) in comparison with Enzyme Linked Immunosorbent Assay (ELISA) for diagnosis of HBV infection among blood donors was investigated. A total of 183 blood donors were selected for this study, they were screened for HBsAg (Hepatitis B surface antigen) using a commercial rapid Clinotech Diagnostic and an ELISA HBsAg detection kit. Of the 183 serum samples 16.9% (31/183) were negative and 83.1% (152/183) were positive for the presence of HBsAg using ELISA. For Clinotech, 39.9% (73/183) were negative and 60.1% (110/183) were positive for the presence of HBsAg. The ELISA kit detected 23.0% (42/183) more positive serum samples compared to the Clinotech assay kit. An indication that the Clinotech assay kit was less sensitive than ELISA kit used in the present study, and that it should not be used alone for the screening of HBsAg.

Key words: Hepatitis B Virus, Diagnostic Kits, Blood donors, Sensitivity, Specificity, Nigeria

INTRODUCTION:

Hepatitis B virus (HBV) is a major cause of liver disease morbidity and mortality worldwide, accounting for over 360 million cases of chronic hepatitis and 620,000 deaths per year [1]. It is hyper endemic in Sub-Sahara Africa (SSA) and a major cause of chronic liver disease [2]. Prior reports have suggested a prevalence of 10-15% in the average risk Nigerian population [1]. In Nigeria, high HBV prevalence of 5.8% among voluntary blood donors has been reported [3]. The common routes of transmission of HBV include perinatal, early in apparent childhood infection, tribal tattooing and scarification, sexual contact, blood transfusions, unsafe injection practices, injecting drug use and occupational exposure of health care workers [4]. HBV attacks the liver and can cause acute hepatitis and chronic disease such as chronic hepatitis B (CHB), cirrhosis and hepatocellular carcinoma (HCC).

Transmission to newborns from HBsAg positive mothers result in chronicity in over 90% of children while less than 10% of adults with acute HBV progress to chronic infection [4]. Most adult infected with HBV at early stage of their life may develop CHB without any symptoms, thus making the virus to be spread to others [5]. Therefore, to reduce the transmission and spread of HBV infection, accurate detection of HBV during blood transfusion is essential. Since HBsAg is the first marker to appear and become detectable within 4-12 weeks of acute infection; most diagnostic centres always use it for the screening of HBV infection [6]. When HBsAg persists for more than 6 months HBV become chronic, therefore, HBsAg is used as the viral marker for both diagnoses of acute and CHB infection. Rapid diagnostic tests (RDTs) which are considerably cheaper, faster and require no special training based on immunochromatography principles are widely used in Nigeria for the detection of HBsAg.

However, the problem is whether the immunochromatography assays (ICAs) can detect an acute HBV or CHB infection accurate enough since both have serious consequences in HBV infection control in Nigeria. Many studies have been performed to determine the accuracy indices of ICA based rapid tests on HBsAg detection. An important feature is that different ICAs have shown different accuracy levels, although these assays are based on the same principle [5]. It has been observed that ICA called Daina screen showed various sensitivity and specificity and therefore not reliable and should be backed up by other methods such as Enzyme Immunoassay (EIA) and Polymerase chain reaction (PCR) for detecting HBV infection since variant forms can be found in different countries [7,8]. Also, all ICAs do not possess equal sensitivity to detect all these HBV subgroups, which means some

products have less sensitivity to detect HBsAg from a certain HBV subtype [5]. It is unsafe to depend on the studies that have been performed in other countries because genetic diversities in HBV can result in differences in accuracy indices for detecting HBsAg for a given ICA based rapid test. In some recent studies in Nigeria, different rate of sensitivity, specificity, negative predictive value and positive predictive values of uncommon ICA kits for HBsAg detection in Ibadan and Calabar were found [9, 10]. Therefore, this study was conducted to compare the sensitivity and specificity of ELISA and the most common rapid ICA based techniques that have been widely used in Nigeria for serum HBsAg detection.

METHODOLOGY:

This cross-sectional study was carried out among blood donors at the Blood Transfusion Unit of Department of Hematology, Ladoke Akintola University of Technology Teaching Hospital (LTH), Osogbo, Nigeria. A total of 183 blood donors, consisting of 77.1% (141/183) males and 24.6% (45/183) females, age ranges between 18 and 56 years were enrolled in the study. These prospective blood donors were initially sorted using a structured questionnaire on risk behaviours and were physically examined by a clinician.

Ethical approval was sought from the ethical review committee of LTH, Osogbo, Nigeria and

this was approved. Informed consent was obtained and form duly signed by each participant. Blood was collected by venipuncture and transferred into a labeled plain bottle.

The 183 blood samples collected were processed in the Haematology and Medical Microbiology Laboratories of the hospital. The 183 blood samples were screened for HBsAg using rapid Clinotech Diagnostic HBsAg detection kit (Horses Shoe Way Richmond B.C V7A 5H5, Canada) and Enzyme Linked Immunosorbent Assay kit (Bio Rad, UK). Analytical procedures were carried out according to the Manufacture's protocol.

The data were analyzed using Statistical Package for Social Sciences (SPSS version, 2016); p value less than 0.05 was considered to be statistically significant.

RESULTS:

Table 1 shows HBsAg detection using Clinotech and ELISA. Of the 183 blood samples tested with ELISA 16.9% (31/183) serum samples were negative and 83.1% (152/183) serum samples were positive for the presence of HBsAg. For Clinotech, 39.9% (73/183) were negative and 60.1% (110/183) positive for the presence of HBsAg.

The prevalence of HBV infection is higher among male participants 86.3% (158/183) than

females 13.7% (25/183). The number of HBV positive samples was higher with ELISA than Clinotech rapid kit. Positive predictive value (PPV), negative predictive value (NPV), sensitivity and specificity for HBsAg detection were calculated for Clinotech HBsAg Rapid test and ELISA (Table 2).

Table 1: HBsAg detection using Clinotech and ELISA

Assay for HBsAg detection	HBsAg Negative	HBsAg Positives
Clinotech	73 (39.9 %)	110 (60.1%)
ELISA	31 (16.9 %)	152 (83.1%)

Table 2: Accuracy indices of the Clinotech and ELISA

Accuracy indices	PPV (%)	NPV (%)	Sensitivity (%)	Specificity (%)
Clinotech	100.0	88.4	42.5	100.0
ELISA	100.0	100.0	100.0	100.0

DISCUSSION:

In Nigeria, ICA based rapid diagnostic kits are widely used to detect HBsAg for both diagnosis and screening of HBV infections, instead of advanced and accurate methods such as ELISA. Negative samples from patients referred for rapid assay are seldom re-tested, considering the costs of retesting in resource poor settings; hence, performing a test with high sensitivity and NPV is more important than choosing a test with high specificity and PPV for routine use [11, 12]. Results of this study indicated that Clinotech rapid kits are less accurate when compared to the ELISA.

Specificity and PPV were 100% for Clinotech. However, the sensitivity and the NPV were less when compared to the ELISA. Several evaluation studies have noted that the specificity and the PPV are high in ICAs but sensitivity and the NPV are less as observed in our study. Khan *et al.* [8] reported specificity and PPV of 79% and 98.9% respectively. Similarly, Afolabi et al. have also posited that the sensitivity of most of the rapid test kits is not adequate when compared with EIA for early detection of HBV infections [9]. Different ICA based rapid assays used for HBsAg detection in the serum may not have the same accuracy

index in every region due to different prevalence and circulating subtypes of HBsAg in different locations. In such cases ICA that does not cover these subtypes will not be ideal for routine testing.

This may be the reason why serum samples that were non-reactive for Clinotech were reactive using the ELISA technique in our present study. Further work is needed as data on the circulating genotypes and mutants of HBV are not widely available in Nigeria. ICAs need regular validation with an accepted EIA for the detection of HBsAg if rapid ICAs are used for diagnostic and screening purposes in resource poor settings.

Rapid assays must be used with caution and it is also important to validate these rapid assays by testing them in each population to assess the effectiveness of these assays in detecting the genotypes and subtypes of HBV circulating in the region before using these tests routinely in diagnostic laboratories.

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