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Brain of Deceased Infant

Nutritional Quality and Health

Highlights

Identification of Mycotoxins

Disease Amongst University Students

Discovering Thoughts, Inventing Future

Volume 14 Issue 5 Version 1.0

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Contents of the Issue

i. Copyright Notice
ii. Editorial Board Members
iii. Chief Author and Dean
iv. Contents of the Issue

1. Family of Six, their Health and the Death of a 16 Month Old Male from Pulmonary Hemorrhage: Identification of Mycotoxins and Mold in the Home and Lungs, Liver and Brain of Deceased Infant. *1-11*
2. Out of Pocket Spending for Febrile Illnesses among Children Admitted to two Teaching Hospitals in Sri Lanka. *13-18*
3. Media Reportage of the Ebola Crisis: Lessons from Nigeria. *19-24*
4. Knowledge Regarding Sexually Transmitted Disease Amongst University Students in Pakistan. *25-28*
5. Nutritional Quality and Health Benefits of Okra *(Abelmoschus Esculentus)*: A Review. *29-37*

v. Fellows and Auxiliary Memberships
vi. Process of Submission of Research Paper
vii. Preferred Author Guidelines
viii. Index

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Family of Six, their Health and the Death of a 16 Month Old Male from Pulmonary Hemorrhage: Identification of Mycotoxins and Mold in the Home and Lungs, Liver and Brain of Deceased Infant

By Jack Dwayne Thrasher, Dennis H Hooper & Jeff Taber

Abstract- The health of a family of six residing in a water-damaged home is presented. The family consisted of the parents (age 29) two boys (ages 8 and 12) and new born fraternal twins (male and female. The parents and two boys developed RADS/asthma and had multiple symptoms including nose bleeds.The fraternal twins experienced respiratory illness that required hospital treatments. The infant girl survived while her brother was found face down, blue in color, lifeless with oral and nasal blood discharge. Pathology demonstrated areasof peribronchial inflammation, intra-alveolar, and numerous hemosiderin laden macrophage (hemosiderosis). Environmental evaluation of the home revealed *Stachybotrys, Aspergillus/Penicillium*, *Cladosporium* and *Chaetomium* in various rooms of the home. Mycotoxins detected in the home included Sterigmatocystin, 5 methoxy-sterigmatocystin Roquefortine C, Satratoxin G and H, Roridin E and L-2, isosatratoxin Fas well as other *Stachybotrys* secondary metabolites. *Aspergillus versicolor* was identified by PCR-DNA analysis in the lungs and brain of the deceased child. Aflatoxin was detected in his lungs, while monocyclic trichothecenes were identified in the lungs, liver and brain. The literature is briefly reviewed on the subject of fungi and their secondary metabolites present in water-damaged homes and buildings.

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Family of Six, their Health and the Death of a 16 Month Old Male from Pulmonary Hemorrhage: Identification of Mycotoxins and Mold in the Home and Lungs, Liver and Brain of Deceased Infant

Jack Dwayne Thrasher [α], Dennis H Hooper [σ] & Jeff Taber [ρ]

Abstract- The health of a family of six residing in a water-damaged home is presented. The family consisted of the parents (age 29) two boys (ages 8 and 12) and new born fraternal twins (male and female. The parents and two boys developed RADS/asthma and had multiple symptoms including nose bleeds.The fraternal twins experienced respiratory illness that required hospital treatments. The infant girl survived while her brother was found face down, blue in color, lifeless with oral and nasal blood discharge. Pathology demonstrated ares of peribronchial inflammation, intra-alveolar, and numerous hemosiderin laden macrophage (hemosiderosis). Environmental evaluation of the home revealed *Stachybotrys, Aspergillus/Penicillium*, *Cladosporium* and *Chaetomium* in various rooms of the home. Mycotoxins detected in the home included Sterigmatocystin, 5 methoxy-sterigmatocystin Roquefortine C, Satratoxin G and H, Roridin E and L-2, isosatratoxin Fas well as other *Stachybotrys* secondary metabolites. *Aspergillus versicolor* was identified by PCR-DNA analysis in the lungs and brain of the deceased child. Aflatoxin was detected in his lungs, while monocyclic trichothecenes were identified in the lungs, liver and brain. The literature is briefly reviewed on the subject of fungi and their secondary metabolites present in water-damaged homes and buildings.

I. Introduction

Water incursion into buildings and homes leads to an increased frequency of upper and lower respiratory disease and abnormal lung function in adults and children (1-12). Spontaneous pulmonary hemorrhage in infants is rare. Known causes in children and adults include environmental tobacco smoke, infections, traumatic injury, e .g. intratracheal tube, cardiac and vascular processes, e.g. von Willebrand disease (13). Pulmonary hemosiderosis (PH) is the result of chronic and recurrent pulmonary bleeding with the occurrence of hemosiderin laden pulmonary macrophages. Pulmonary hemorrhage associated with water intrusion, *Stachybotrys chartarum, Aspergillus, Penicillium* and tobacco smoke in Cleveland, Ohio was reported (14-16). Additional cases of PH include a one month-old infant with no environmental tobacco smoke and the presence of Aspergillus/Penicillium *spp, Memnoniella*, *Alternaria, Cladosporium, Chaetomium, Torula* and *Stachybotrys.* Roridin L-2, Roridin E and Satratoxin H were identified in a sample from the bedroom closet ceiling (17); PH in a 40 day-old male infant exposed to *Penicillium* and *Trichoderma* species for 2 weeks followed by an acute exposure to tobacco smoke (18); and an infant with pulmonary hemorrhage (19). Finally, *Stachybotrys chartarum* was isolated from the lungs of a 7 year-old male who recovered from pulmonary hemorrhage (20).

Hemolysins are produced by a several species of mold isolated from the homes associated with pulmonary bleeding in the Cleveland homes (21, 22). However, other mold contaminants probably have a role in illnesses associated with mold exposure in water damaged structures. For example, mycotoxins have been demonstrated in the air, dust and building materials contaminated with mold. These include, but not necessarily limited to sterigmatocystin, trichothecenes, aflatoxins, gliotoxin, chaetoglobosum A, Roquefortine C (12, 23-30). In addition, trichothecenes have been identified in the sera of individuals exposed to *Stachybotrys chartarum* (31) while gliotoxin is present in the sera of patients and mice with invasive aspergillosis (32} Trichothecenes, aflatoxins and ochratoxins are present in biopsy and autopsy specimens obtained from mold exposed subjects (33). More recently, trichothecenes, ochratoxins and aflatoxins were reported in the urine, nasal secretions, sinus biopsies, umbilical cord and placenta from a family of five with illnesses associated with a mold

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infested water-damaged home (34). In addition, individuals exposed to mold in their water-damaged homes with chronic fatigue also have the same mycotoxins in their urine (35).

In this communication we report on a healthy family of 6 (nonsmokers) who developed multiple symptoms and health problems (e.g. nasal bleeding, sinusitis, asthma, RADS) following a prolonged exposure to several genera of mold in a water damaged home. Most significantly, fraternal twins were hospitalized with pulmonary bleeding. The female survived but developed RADS. The male twin died from respiratory failure and pulmonary bleeding. Both had *in utero* and neonatal exposure to these molds and their mycotoxins, including *Stachybotrys chartarum*. Real time PCR detected *Aspergillus versicolor* DNA in the brain and lungs of the deceased infant, while an ELISA procedure detected aflatoxins and trichothecenes in the lungs, liver and brain in autopsy materials from the deceased infant. In addition, mycotoxins produced by *Penicillium sp.*, *Asp. versicolor* and *S. chartarum* were detected in bulk and dust samples from the home by LC/MS/MS.

II. Materials and Methods

a) Description of the Home

The 3 bedroom home was located in Visalia, California. Construction was wood framing, exterior stucco, dry wall interior, asphalt shingles, fireplace, wood sub flooring, crawl space, attic and central air condition. It consisted of the following occupied rooms: Living room with a corner fireplace, play room with a baby crib, infant's bedroom where the twins slept, den immediately adjacent to the infant's bedroom, master bedroom, add on office, kitchen and two bath rooms. Upon moving into the home it was noticed to be in disrepair. The carpet was wet, moldy and falling apart with a musty odor. There was discoloration of ceiling dry-wall indicative of water intrusion, and water damage to the flooring. Occupation of the home began in August 1993 and vacated on November 11, 2001. The home was inspected by the Joseph Company, Fresno, California. The following defects were noted: (1) faulty roofing; (2) increased moisture readings from 30 to 100 %; (3) Ceiling water stains throughout the house; (4) Visual mold growth; and (5) improperly installed shingles which allowed moisture intrusion under the shingles and into the interior of home, e.g attic and wall cavities. The home was eventually razed because of the disrepair, water damage and mold growth.

b) Mold Testing (Air, swab and Bulk Sampling

Visual inspections, bioaerosols, bulk and wipe sampling of the home were done under the direction of Jeff Taber, Kings County Public Health Department. Bulk, wipe and air bioaerosols were sent under chain of custody to Aerotech Laboratories (Currently EM Lab P & K, Phoenix Arizona) to identify mold to at least the Genus level. Air sampling was accomplished usingThis rate is impossible Air-o-cells are rated for 15 lpm. Correct this typo.

c) Environmental Myco toxin Testing

Bulk and wipe samples were taken from various areas of the home and sent under chain of custody to P-K Jarvis (currently Bureau Veritas North America), Novi, Michigan to test for a variety of mycotoxins produced by *Aspergillus* and *Penicillium spp.* and *Stachybotrys chartarum*. The samples were extracted with methanol, run on LC/MS/MS and analyzed by John Neville, Ph.D.

d) Autopsy of the Deceased Child

An autopsy was performed by G. Walter, MD, Coroner's Office, Tulare County, California. A second opinion regarding the results of the autopsy and histopathology was done by a pediatric pathologist D. Scharnhorst, M.D., Ph. D, Valley Children's Hospital, Madera, California. Histology slides were only stained with Hematoxylin Eosin. Paraffin embedded and frozen samples of liver, lung and brain of deceased infant were sent to RealTime Laboratories, Carrollton, Texas to test for mycotoxins and the presence of mold DNA.

e) Hypersensitivity Pneumonitis and Mycotoxin Antibodies:

Serum samples from the surviving members of the family were sent to Aerotech Laboratories (Currently EMLab P & K) to perform the Hypersensitivity Pneumonitis Panel and for the detection of IgE, IgA and IgM antibodies against various molds. Antibodies against aflatoxin, trichothecenes and satratoxin adduct and *Stachybotrys chartarum* in sera of the family were tested by Immunosciences as previously reported (36).

f) Real Time PCR (RT-QPCR) Mold DNA Analysis

The DNA probes for mold species utilized in the RT-QPCR included species of *Aspergillus, Penicillium* and *Stachybotrys chartarum* were developed and patented by Real Time Laboratories, Carrollton. Texas. The RT-QPCR was carried out as published (37). The tissues used for mold DNA and mycotoxins were emulsified and extracted as described (33-35) are briefly reviewed below.

g) Detection of Mycotoxins in Autopsy Specimens by an ELISA Procedure

25 mg of the lung, liver and brain were received frozen or embedded in paraffin blocks. They were analyzed for aflatoxins (AT), trichothecenes (MT) and ochratoxin A (OTA) using immune affinity columns , and T-2 and HT-2 Ochra Test ,(Afla Test® test kits, VICAM, L.P., Watertown, MA) containing specific monoclonal antibodies. The tissues were emulsified in phosphate buffered saline (PBS, 0.9%) and reagent grade methanol (Sigma-Aldrich).in a 1:1 dilution. To disrupt the cells, tissues were bead beated using silica beads (Sigma-

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Aldrich) for 1 minute at the speed of 45 rpm, heated at 65^0 C for 15 minutes. Samples were centrifuged at 13000 rpm for 2 minutes. 500 µl of cellular extract was placed in a glass tube, and further diluted in PBS prior to testing. All samples were free of paraffin (33-35).

Samples were then applied to an Afla Test® column (VICAM, L.P., Watertown, MA) which contains specific monoclonal antibodies (MT) directed against AT (B1, B2, G1, and G2), OTA) and monocyclic tricho the cenes. Columns were washed twice with reagent grade water (Fisher Health Care, Houston, Texas). The samples were eluted from the column to remove the bound mycotoxins with reagent grade methanol. Fluorochrome developer (AFLATEST ® Developer, VICAM) was added to the extracted methanol. All samples were read by fluorometry (Sequoia-Turner Fluorometer, Model 450, which was calibrated using standards supplied by VICAM (Green Filter = 2, and Red Filter = 120). Spiked standards using known amounts of AT B1, B2, G1, and G2 (Trilogy Analytical Laboratory Inc., Washington, Missouri) of human heart tissue were run as validation controls prior to testing (sensitivity of 95% and specificity of 92%). Known controls of mycotoxins (50 ppb, 25 ppb, and 1.25 ppb, Trilogy Analytical Laboratory and Real Time Laboratories, Carrollton, Texas) were run with each test. The eluted solution was then read by fluorometry at 450 Angstroms. The lower and upper limits of detection are 1.0 and 23.0 parts per billion (ppb) calibrators, respectively. Test results are plotted against the standard curve of the calibrations. Results were reported in ppb.

III. Results

a) Family Health

The two adults, nonsmokers, and two older male children were healthy prior to moving into the mold contaminated home. They resided in the home until November/December 2002. The home was razed in early 2002. Within two months of occupancy all members began to experience symptoms and health problems that are summarized in **Tables 1 and 2.** All surviving members developed lung disease and were positive when tested for Hypersensitivity pneumonitis (**Table 2**) and were given the diagnosis of RADS/asthma with prescribed bronchodilators. In addition, all members of the family had reduced RBC hemoglobin (Hb) and were diagnosed as anemic. Nose bleeds and a flu-like illness were other common symptoms (**Table 1**). After moving out of the contaminated home, their health improved, however, they remained symptomatic with the RADS/asthma as well as other symptoms such as fatigue and generally not feeling as well as they did prior to occupation. There was no family history of von Willebrand disease.

Table 1 : This table summarizes to health and symptoms of the family members. All members of the household were healthy prior to moving into the contaminated home. The fraternal twins were born after moving into the home

Family Member	Health and Symptoms
Father, Age 29	Nonsmoker, Flu-like symptoms, nausea, blurred vision, headaches, dizziness, fainting spells, excessive weakness, shortness of breath, nose bleeds, inability to concentrate, loss of memory, abnormal PFT RADS. Albuterol.
Mother, Age 29	Nonsmoker, Flu-like symptoms: Fever, chills, fatigue, Pharyngitis, bowel cramping, sinus congestion, coughing, shortness of breath, chest tightness, sneezing, headache, decreased Hb, RBC (anemia) and increased neutrophils. Negative allergy skin testing. Abnormal PFT RADS. Albuterol.
Son, age 10 (Son 1)	Normal well baby Exam. Flu-like symptoms, skin rash, frequent colds, sore throat, fevers, coughing, shortness of breath, vomiting, gastroenteritis, conjunctivitis RADs/asthma, Albuterol
Youngest Son, age 8 (son 2)	Normal well baby exam. Flu-like illness, developmental delay, bilateral OTM, conjunctivitis, chest congestion, sinusitis, headaches. At age 4 diagnosed with developmental delay, delayed speech and language, and at age 6 with autistic spectrum disorder. RADS
	requiring Albuterol.
Fraternal Twin (female) 18 moths	Normal well baby exam. Symptoms began at approximate 3 months of age: fever, congestion, coughing, hoarseness, shortness of breath, nasal bleeding, , vomiting, patchy pneumonia, increased sed. rate, elevated neutrophils, decreased RBC hemoglobin, anemia, diagnosis of asthma, wheezing, Pulmocort and Albuterol. One hospital stay, recovered, sent home.

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Deceased Fraternal Twin (male), 18 months	Normal well baby exam. At home he had Flu-like symptoms, cyanotic episodes, limp, lethargy, sweating, shaky, tonsillitis. OTM, bronchitis, bilateral wheezing, eyes rolling back, decreased RBC hemoglobin, several hospital visits for respiratory difficulties for turning blue, being limp and difficulty breathing. He was found nonresponsive face down in his crib with bloody discharge from nose and mouth. He was pronounced dead on 02/19/2001 and was taken to Country Coroner's Office for autopsy. Bacterial throat cultures, May, 2000 were negative fro Strep at 24 hours

Table 2 : This table summarizes the results of the Hypersensitivity Pneumonitis (H.P.) panel performed on the family by Quest Diagnostics as well has their major symptoms. The five surviving members were diagnosed with Hypersensitivity Pneumonitis and Antibodies to mycotoxins

Organism	Mother[1]	Father[2]	Son (1))[3]	Son (2)[4]	Female Twin[2]
M. faeni	+	+	+	+	+
A. pullulans	+	+	-	-	-
A. Alternata	-	+	-	-	-
A. fumigatus	-	+	-	-	-

1. *Mother: H.P., fever, chills, fatigue, H.A.s, diarrhea, Pharyngitis, GERD, SOB, chest and nasal congestion, nose bleed, sneezing, negative allergy testing.*
2. *Father: H.P., asthma, Dizziness, H.A.s, nosebleed, SOB, fatigue, muscle twitching, decreased concentration and memory, skin rashes and petechae. Allergic to dust mites and pollen. SOB, RADS with abnormal PFT*
3. *Eldest Son: Skin rash, fever, nose bleed, coughing, gastroenteritis, conjunctivitis. H.P.*
4. *Son: Developmental delay (autistic spectrum), comprehension and language delay, fever, erythematous skin rashes, diarrhea, coughing, H.A.s, sinusitis, nose bleed SOB, H.P.*
5. *Female Twin: fever, nasal and chest congestion, nose bleed, pneumonia requiring hospitalization, H.P., SOB, RADS requiring Pulmocort and Albuterol*

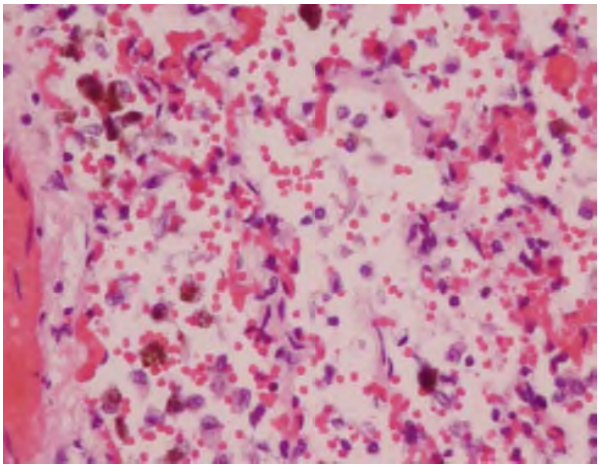
b) Health of the Fraternal Twins

The female twin had nasal bleeding, fever, deceased RBC hemoglobin (anemia) coughing and difficulty breathing. She was hospitalized once and released after being stabilized. The male sibling upon arriving home put in following birth birth he had ER visits, frequent physician visits and was in hospital for severe respiratory problems. At home he was found face down in his crib motionless, blue and with blood coming from the nose and mouth. He was pronounced dead upon arrival at the hospital.

c) Autopsy of the Deceased

The following abnormalities were listed in the final autopsy report: (1) liver had mold congestion; (2) Heart had mild hypertrophy without inflammation; (3) Lungs had marked vascular congestion, foci peribronchial inflammation, intra-alveolar blood numerous aggregates of pigment laden macrophages (hemosiderosis) (**Figure 1**). All other organs were normal in appearance.. The cause of death was listed as respiratory failure with pulmonary bleeding and hemosiderosis.

A. Histology of the Lung (H & E)



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B. Autopsy Slides of Lung (H & E)

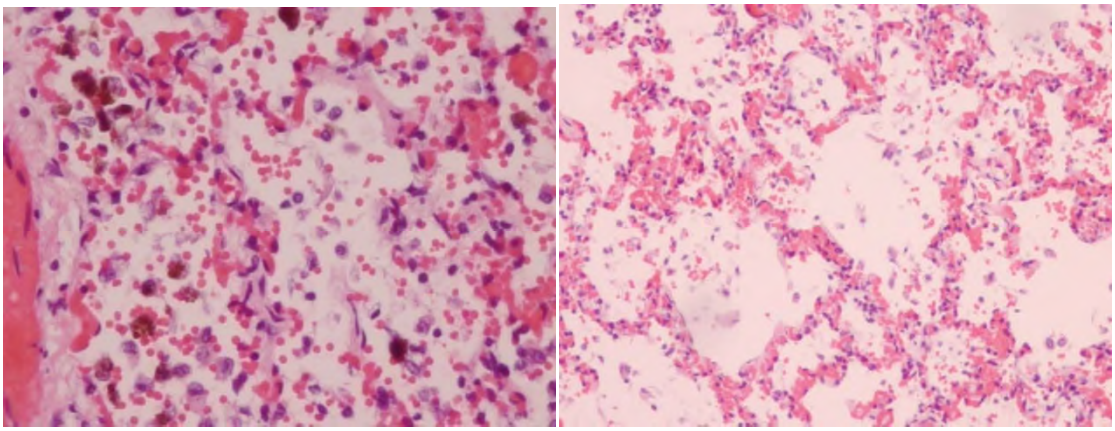


Figure 1: On the Left Lung histology stained with Hematoxylin and Eosin demonstrating markedly congested Alveolar spaces with desquamated cells and blood, hemosiderin-laden macrophages on the right, no inflammation, normal appearing blood vessels and no inflammation

d) Hypersensitivity Pneumonitis and Antibodies to Mycotoxins

The father, mother, two boys and the surviving twin were positive with respect to the Hypersensitivity pneumonitis panel (Table 2). The father had positive IgG antibodies to the four molds (*M. Faeni, A pullulans, A. alternata* and *A. fumigatus*) followed by the mother (*M. faeni and A. pullulans*) and the three children (*M. Faeni*). All experienced symptoms of shortness of breath (SOB), RADS and/or asthma requiring bronchodilators.

Antibodies against *Stachybotrys chartarum* were positive in each family member as follows: Father (IgA and IgG); Mother (IgA); two sons (IgG) and twin daughter (IgG). The data on titers are not shown.

Antibodies to albumin adducts of AT, trichothecenes (MT) and satratoxin (ST) were positive as follows: (1) Father (IgM against AT, MT and SAT); (2) Mother had AT((IgM), MT (IgA and IgM); and Satratoxin (IgA and IgG)antibodies; (3) Sons – eldest had IgA to SAT and the youngest was not tested; (4) Surviving twin daughter had AT (IgM), MT (IgA and IgM); and SAT IgA and IgG) antibodies. The data on titers against mycotoxins are not shown).

e) Mold Identification in the Home

Mold contamination was determined from bulk, wipe and air samples. The results from bulk samples are presented in Table 3. The major molds identified in these samples *were* Amerospores*, Aspergillus/ Penicillium*, *Cladosporium Stachy-botrys* and *Chaetomium.* Spore counts per gram of sample were: *Amerospores* (2,308 to 11,536). *Stachybotrys* (20,789 to 28,462), *Cladosporium* (2,308 to 3,077). *Aspergillus/Penicillium* (2,308 to 41,536) and *Chaetomium* (2,308 to 23,308). In addition, *Stachybotrys* and *Chaetomium* were identified in a sample from the children's playroom contained *Stachybotrys*.

Table 3 : This table summarizes the identification of spore types detected in bulk samples obtained from rooms of the home. The samples were examined by Aerotech Laboratories, Ind., Phoenix AZ. The data are expressed as spore counts/gram

Room	Alternaria	Amerospors	Stachybotrys	Cladosporium	Asp/Pen	Chaetomium
Fireplace Floor		8,889				
Living Room N. Wall		7,407				
Addition S. Wall			28,462		17,692	2,308
Addition - Middle		3.077	22,308	3,077		12,308
Addition W. Wall		2,308	13,077	2,308		
Closet Bedroom		11,538			41,536	
Master Bdrm Floor		8,462			2,308	
Master Bdrm Floor		4,615				
Den Closet Ceiling			10,769			
A.C. Filter		308,200		161,000		

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Ascospores and Basidiospores were also present in some rooms of the home. Torula was detected in Addition room W. wall sample. Air spore counts total 1,577 to2, 222sporex/m^3. *Stachybotrys and Chaetomium were not detected in the outdoor air samples. Stachybotrys was detected in air of the children's play room. .Stachybotrys and Chaetomium spores were detected in the carpeting.*

f) Mycotoxin Identification in the Home

The results for the detection of mycotoxins in bulk samples are presented in **Table 4.** The results are designated as present (at or above detection limit) or not present (not detected). Sterigmatocystin and 5-methoxysterigmatocystin were detected in three rooms, the air conditioning duct and AC filter. Sterigmatocystin was at or above the reporting limit of 20 ng. Chaetoglobo sum A, B, and C were not identified. Roquefortine C was detected in two rooms, The most commonly detected mycotoxins were the trichothecenes: Satratoxin H (detection limit of 7.0 ng), Isosatratoxin F, Satratoxin G, Roridin L-2, Isororidin E, and Roridin E. In addition, the *Stachybotrys* metabolites 6B-Hydroxydolaabella MER-5003 Mol. Wt. 47 and Mol. Wt 412 were also present. Standards were not available for several of the mycotoxins (**).

Table 4 : This table summarizes the mycotoxins detected in dust samples from various areas of the house. The tests were performed by Jon Neville, PK-Jarvis, Novi, MI

Mycotoxin	Living Room N. Wall	Room Addition W. Wall	Room Addition Middle	NW Bdrm Closet	Living Room Floor at Fireplace	Room Addition SW Wall	Room Addition S. Wall	Room Addition N. wall	Reporting Limit in ng
Sterigmatocystin	--	Present	--	--	--	Present	Present	--	20
5-methoxysterimatocystin	--	Present	--	--	--	Present	Present	--	**
Chaetoglobosum A	--	NP	NP	NP	--	NP	NP	NP	**
Chaetoglobosum B	--	NP	NP	NP	--	NP	NP	NP	**
Chaetoglobosum C	--	NP	NP	NP	--	NP	NP	NP	**
Griseofulvin	--	NP	--	--	--	NP	NP	--	10
Roquefortine C	--	Present	--	--	--	Present	NP	--	0.4
Satratoxin H	NP	Present	Present	NP	NP	Present	Present	Present	7.0
Trichodermol	NP	NP	NP	NP	NP	NP	NP	NP	**
Trichodermin	NP	NP	NP	NP	NP	NP	NP	NP	**
Isosatratoxin F	NP	Present	NP	NP	NP	Present	Present	Present	**
Satratoxin G	NP	Present	NP	NP	NP	Present	Present	Present	**
Roridin L-2	NP	Present	NP	NP	NP	Present	Present	Present	**
Isororidin E	NP	Present	NP	NP	NP	Present	Present	Present	**
Roridin E	NP	Present	NP	NP	NP	Present	Present	Present	**
Epoxydolabellane A	NP	NP	NP	NP	NP	NP	NP	NP	**
6B-Hydroxydolaabella	Present	Present	Present	NP	Present	Present	Present	Present	**
MER-5003 M. Wt. 470	Present	Present	Present	NP	Present	Present	Present	Present	**
MER-5003 W. Wt. 412	Present	Present	Present	NP	Present	Present	Present	Present	**

*Abbreviations: ** (standards not available; -- (not tested); NP (not present)*
Air Conditioning System: A wipe sample form the air conditioning duct was positive for the presence of Sterigmatocystin, 5-Methoxysterigmatocystin and Roquefortine C. A bulk sample from the A.C. filter was positiveforSterigmatocystinand5methoxysterigmatocystin

g) PCR DNA Test Results of Deceased Tissues

Real-Time PCR analysis detected *Aspergillus versicolor* in the frozen and paraffin embedded tissues as follows: Lung (1056 spores/g; Liver (0) and brain (7 spores/gram) **Table 5)**.

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Table 5 : This table summarizes the results of PCR DNA testing by EMSL Laboratory Analytical that detected *Aspergillus versicolor* in the lungs, liver and brain of the deceased

Sample	Species *Aspergillus versicolor*	Spores/g Paraffin embedded tissue
Lung	Present	1066
Liver	Absent	0
Brain	Present	7

h) Mycotoxins Detected in the Deceased Tissues

Figure 2 summarizes the results of the mycotoxin concentrations detected in the lung, liver and brain of the deceased twin. OTA was not detected. AT was detected at a concentration of 0.2 ppb in the lung. The T-2 Tag that identifies several trichothecenes (e.g. T-2, HT, Acetyl T-2) were as follows: Lung at 4.6 ppb, liver at 4.3 ppb and brain at 0.3 ppb.

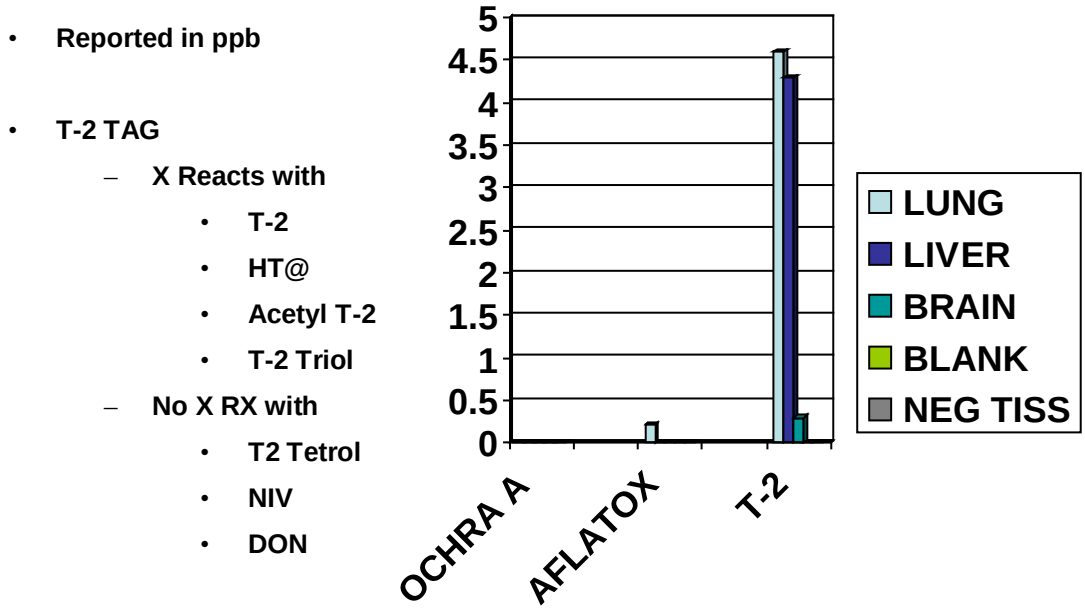


Figure 2 : Fluorometry Results by Organ. Extracted mycotoxins from tissue with paraffin embedded blocks. Grind Tissue, Blend sample with PEG, Pass through column, Wash with tween and water, Elute Antigen (i.e. T-2) from column with methanol, Use calibrated fluorometer, Results are reported as present in parts billion (ppb)

IV. Discussion

The initial literature regarding pulmonary hemorrhaging in infants and mold was limited to the identification of molds, including *S. chartarum*, in the homes of the affected infants. As a result, we have held on to the data presented herein until sufficient information became available in the literature to discuss the health affects observed in this family.

The question is what is the mode of exposure to antigens and toxins in these environments? Bench experiments and results from indoor testing of water damaged homes offer some insight. Bench testing has demonstrated that colonies of mold and bacteria shed particulates (fungal fragments) less than the size of spores in the range of 0.03 to 0.3 microns. The question is what is the mode of exposure to antigens and toxins in these environments? Bench experiments and results from indoor testing of water damaged homes offer some insight. Bench testing of agar plates with growth of *Stachybotrys*, *Cladosporium, Penicillium* and *Aspergillus* has demonstrated that the mechanisms involved in this release includes colony structure, moisture conditions, air velocities and vibration (38-41). The fragments contain antigens, mycotoxins, glucans, endotoxins, exotoxins and a variety of digestive proteins and hemolysins (21, 22, 38, 40, 42,43).The ratio of fungal fragments to spores (F/S) in the indoor in moldy houses has been calculated. The F/S for fragment sizes of 0.03 to 0.3 would be between10^3 to 10^6. These results indicate that the actual contribution of the fungal fragments to the overall exposure may be very high, even much greater than original estimates of 500 times the spore count (40, 41). The aerodynamic characteristics of the fungal fragments apparently have a respiratory deposition 230-250 greater than spores.

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With respect to infants, the lower airway deposition is 4-5 times greater than that for adults (41).

The family lived for 8 years in the water damaged home with musty odors and visible mold that resulted from faulty roofing. Inspection and testing of the home led to the identification of elevated *Aspergillus/Penicillium spp*, *Chaetomium*, *Stachybotrys chartarum* among other genera in bulk samples taken from several areas of the home. *S. chartarum* was present in samples taken from the fraternal twins play room (family den) as well as living room (addition walls) (**Table 3**). The condition of the home was sufficiently serious that the Fresno County Department of Health required the family to move out. The home was eventually razed because of mold contamination and construction defects.

LC/MS/MS detection of mycotoxins demonstrated the presence of *S. chartarum* trichothecenes in bulk samples from areas of the home, including the twin's playroom. Additionally, sterigmatocystin, 5-methoxysterigmatocystin and roquefortine C were also detected in the home and the HVAC system (**Table 4**). These observations add to the increasing evidence that mycotoxins are present in water-damaged buildings and homes. As such they represent a toxic source of exposure via inhalation as well as oral and skin exposure (12, 17, 23-30, 33-35, 42).

The parents and two older children experienced a chronic flu-like condition with multiple symptoms as summarized in **Table 1**. These included nasal congestion and bleeding, sinusitis, headaches, fatigue, decreased ability to concentrate and respiratory difficulties diagnosed as RADS/asthma condition requiring bronchodilators. In addition, they had positive antibodies to the hypersensitivity pneumonitis panel (**Table 2**). It is well recognized that respiratory disease and infections occur in occupants of buildings and homes with water-damage and the presence of mold, bacteria and their secondary metabolites (1-12). The fungi associated with respiratory disease include the genera of *Alternaria, Aspergillus, Cladosporium* and *Penicillium* (1-12, 44, 45).

The entire family had episodes of nose bleeds. However, the conditions of the twins were more serious leading to hospital stays. It is noteworthy that Stachylysin has been detected in the sera of mice, humans and indoor environment of water damaged homes and buildings (46). In addition, several species of *Aspergillus* and *Penicillium* are known to produce hemolysins and probably siderophores (21, 22, 47-49). Thus, both nasal and pulmonary bleeding may well have been the result of multiple mold hemolysins as well as infection from mold and bacteria. The female twin recovered sufficiently but developed RADS. The fraternal brother was found dead in his crib with bleeding from his nose and mouth. The autopsy revealed pulmonary bleeding and hemosiderosis (**Fig. 1**). PCR-DNA demonstrated *Aspergillus versicolor* in his lungs, which produces Versilysin (21, 22). In addition, AT (lungs) and MT (lungs, liver, and brain) were present in the autopsy samples. The observations on the deceased twin, as well as the other members of the family, point towards the recognition of fungi and their secondary on the health of the occupants. The presence of multiple biocontaminants, their complexity of damp indoor spaces as well as microbial particulates ranging from 0.03 to 0.3 microns probably have an impact upon human health that should be taken into account (31, 34, 35, 38-42). Finally, it is becoming increasingly apparent that occupants of water damaged environments have mycotoxins in their serum, urine, nasal cavity and various tissues (31, 33-35). In conclusion, indoor molds resulting from water-intrusion do produce and release fungal fragments (0.03-0.3 microns), multiple species of mold and bacteria, secondary metabolites, nano--particulates and other biocontaminants that most likely impinge upon the health of occupants (23-31, 38-43).

The younger of the two older sons was diagnosed with developmental delay (autistic spectrum disorder) at age 6. Since this child was in the home from infancy the exposure to microbial secondary metabolites in the home may have contributed to this condition. Information in the literature on autistic spectrum disorders suggests that mold and mycotoxin exposure appear to be contributing factors in this neurological disorder (50-53). If the respiratory deposition of fungal fragments that contain mycotoxins is considered, this is a plausible explanation for his neurological condition. A model of the human nasal-sinus cavity has shown that flow patterns in the ethmoid-sphenoid-olfactory area will allow the deposition of nanoparticles into these structures (54). Furthermore, the instillation of trichothecene mycotoxins into the nasal cavities of rodents and Rhesus monkeys causes rhinitis, nasal inflammation, apoptosis of the olfactory sensory neurons, the olfactory bulb and spreads to the brain of rodents (55-58). Furthermore, fine and ultrafine particulates with attached toxins are translocated to systemic circulation by crossing the alveolar membranes and into the brain via the olfactory tract as well as oxidative stress, systemic inflammation associated in cognitive decline. (59 62).

Comments are in order regarding the role or secondary exposure to cigarette smoke. The CDC pointed out that the Cleveland infants had exposure to tobacco smoke in their homes as verified by Dearborn et al (13, 15). The family in this investigation consisted of nonsmokers, but experienced nasal bleeding and the death of one infant from pulmonary hemorrhage. Although, secondary tobacco smoke contains particulates, nicotine and tars, nitrosamines, PAHs, etc., it should be noted that cured tobacco is contaminated with species of *Aspergillus* and *Penicillium spp*, bacteria as well as aflatoxins (63-66). Thus, the potential role of

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bacteria, fungi and their toxins present in the environmental cigarette smoke in the Cleveland cases should also be considered. However, the members of the family presented herein were expose molds and mycotoxins present in a water-damage home. In addition, *Aspergillus versicolor* DNA and aflatoxins and trichothecenes were detected in the lungs and brain of the deceased infant.

V. Conclusion

The parents and children in this case study were non-smokers. They were exposed to high concentrations of mold spores and mycotoxins present in the indoor environment of their rented home. The parents and siblings experienced multiple health conditions associated with the exposure. With respect to the fraternal twins, the sister developed nasal bleeding, fever, anemia and difficulty with breathing. She recovered sufficiently after being in the hospital and returned home. The male twin died from pulmonary bleeding and failure. PCR-DNA testing revealed Aspergillus versicolor in the lungs, liver and brain. Tests for mycotoxins detected aflatoxin lungs and trichothecenes in the lungs, liver and brain. Thus, exposure to molds and their secondary metabolites present in a water-damaged indoor environment presents a health hazard to the occupants.

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Out of Pocket Spending for Febrile Illnesses among Children Admitted to two Teaching Hospitals in Sri Lanka

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Aim: This study evaluates the extent, impact and reasons for rising OOPS among patients admitted to two teaching hospitals in central Sri Lanka.

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Conclusion: OOPS appears to be a considerable burden on the public. Deficiencies of doctor patient communication and lack of defined target population could be responsible for this situation.

Keywords: *out of focket spending, doctor patient communication, target population, acute febrile illness.*

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I. Introduction

Free health care and education in Sri Lanka date back to the pre-colonial era an up to as far back as 250 BC. The country has maintained commendable health indicators and a high literacy ratio in the region amidst a 35 yearlong precarious war, financial instability and impact of a devastating tsunami. Introduction of free economic policy in 1970's has expanded the provision of health care delivered from the private sector. Though the 2013 United Nations Development Programme Report has categorized the country as a country with "medium human development", (Human development report, 2007), a vast majority of the public represent a lower economic class and the health care seeking pattern has been transformed over the past few decades, which may probably have been influenced by the expansion of the private sector healthcare facilities and changes in the life- styles of the public. Commercialization of the health service has led to escalation of the out of pocket spending (OOPS) of individuals and the nation, which in turn, has caused remarkable economic constraints.

OOPS has been a major concern in the Sri Lankan community in the recent past. Total OOPS in 1990 has gone up by 20 million rupees in 2012 (Sri Lanka Health Accounts, 2008) and currently the major share (83%) of the private sector expenditure on health is paid by OOPS (National health bulletin, 2008, Bandara S.2011).

The Household Income and Expenditure Survey (2012/13) show that in a month, nearly 31.7% of the household population obtains health treatments as outpatients per month (Household Income and Expenditure Survey – 2012/13). This increment of the demand for health services, notably due to epidemics of non-communicable diseases, dengue, intestinal infectious diseases etc,(National Health Bulletin, 2008) and the cost of care amidst an available free health service is mainly due to changes in the health care seeking patterns of the public. Demographic transitions occurring in Sri Lanka, which have a direct impact on the potential demand for healthcare services, have also influenced OOPS. Around 13% of Sri Lanka's population was aged more than 55 years in 2011, compared to half that number four decades ago (RAM Stand point Commentery,2013). On the other hand, optimum utilization of expert services, which are already available in the government sector, has been hindered due to over-crowding and mal-distribution of service demand especially in the rural and sub-urban areas.

Management of most of the acute febrile illnesses should have no cost other than the inevitable cost of transport and loss of work. However many people seems to spend a substantial amount of money on private consultations, investigations and treatment, even amidst their financial constraints. Such health care seeking behaviours inevitably compromise their economic stability as well as individual and family health promotion pursuits.

This situation of irrational spending on ambulatory care is probably contributed to by the expansion of health facilities in the private sector, and without a system of health insurance cover. However

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Deficiencies in the free health care facilities provided by the ever expanding and improving government sector need to be addressed. Furthermore, the problems in the doctor–patient communication, attitudes and beliefs of the general public are playing a pivotal part in this scenario.

This study attempts to evaluate the extent, reasons and impact of out of pocket spending among a series of patients, admitted to two teaching hospitals in central Sri Lanka with febrile illnesses. This study will also apprise the antecedents of such behaviour and patients' perception regarding OOPS on health.

II. Materials and Methods

One hundred consecutive paediatric patients admitted to wards of two adjacent teaching hospitals with acute febrile illnesses were recruited for the study. Non-consenting patients and those with long standing chronic illnesses were excluded. Mixed method of collecting quantitative and qualitative data was adopted. A questionnaire to evaluate the extent, background, reasons and perception about OOPS was developed based on several focus group discussions with admitted patients. A 20-item questionnaire with 4 open ended questions was developed and pre-tested.

Each questionnaire was administered by one of four trained interviewers on 100 consecutive admissions to two teaching hospitals in the Kandy district of central Sri Lanka. Demographic description, monthly income, expenditure and cost of care for the current episode of illness were evaluated. Qualitative data based on their perceptions regarding extra spending on health care was collected using 4 open-ended questions.

III. Results

The total study sample consisted of 56 patients from hospital A and 44 patients from hospital B, representing 28% and 34% of total admissions during that particular period, in hospitals A and B respectively. Majority (83%) was below age 5 years and 10% were between 5 – 8 years and 7% were above 8 years. In the study sample, according to the income, 31(31%), 32(32%), and 33(33%) of parents were in the income categories of <25 000 Rs/month, 25000-50000 Rs/month and>50000 Rs/month respectively.

Table1 : Mean income and expenditure of different economic classes

Economic groups (LKR) (USD)	Number (%)	Mean income (LKR) (USD)	Mean expenditure on this episode (LKR) (USD)	Mean % of expenditure
<25,000 (< 191)	31	17,714 (135)	3370 (25)	33.6
25,000-50,000 (191-383)	37	35,504 (272)	4375 (33)	12.43
>50,000 (> 383)	32	90,879 (695)	8492 (65)	10.66

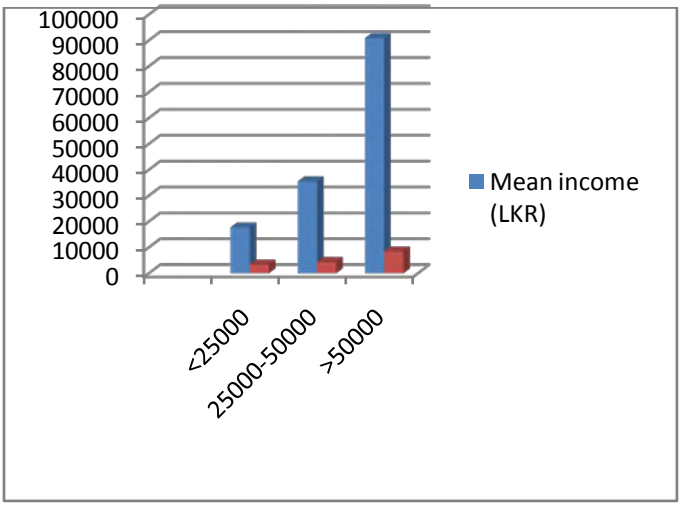


Figure 1 : Mean income and the expenditure on health in different economic classes

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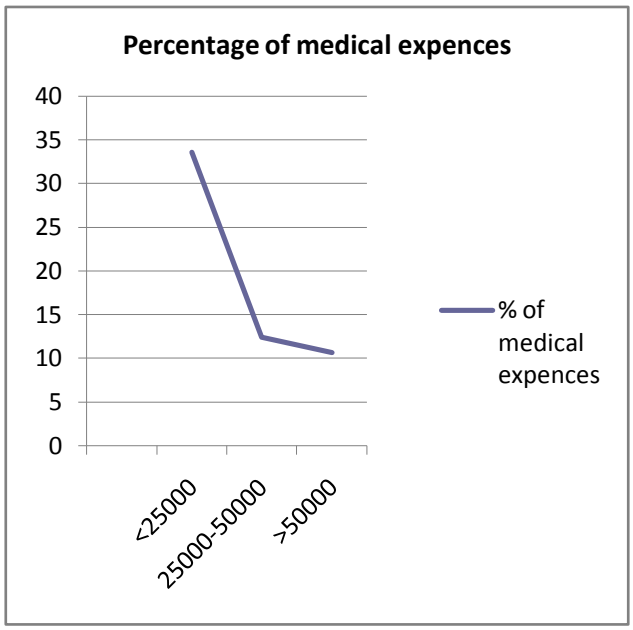


Figure 2 : Changes in the mean health expenses as a percentage of total monthly income with different income categories

Out of the total sample of 100 patients, 89(89%) has tried medication from the private sector prior to admission as their first choice. Total expenditure for this acute febrile illness ranged from Rs 0 to Rs 43,450.00 (Mean Rs 5,432.19) which is 0 % to Rs 468% (Mean 25.95%) of the monthly income. % has spent more than their monthly income for the episode of the current febrile illness. Average expenditure for this episode of illness was 33.6% of the monthly income among those who earn less than 25 000 Rupees per month compared to 10.7% among those who earn more than Rs 50 000/ per month. The major share of the cost was due to loss of work (32%) and travelling (25%), followed by costs for doctor consultation fees (9 %), drugs (11%) and investigations (12%).

Expenses incurred due to acute illness had been a constraint for 94.2% of the study sample. They express their feelings by "It is not easy to spend money like this" "We managed it somehow" "We had to pawn our jewellery", but some had the idea that "it is worth spending on the child whatever the problems we have"

People were happy about the existing health care system "we can trust the government hospitals" and "government hospitals are the places that we have to come at the end"; however some said "they had less response to the treatments from the OPD "we had to waste a lot of time in long queues."

Reasons for out of pocket spending was attributed to appearance of new symptoms (36 cases; 45%), unexpected worsening (12 cases; 15%), fever was not settling (50; 62.5%), and the parents were scared since the child became ill (34 cases; 32.5%). They express their feelings "the doctors are too busy" "the health staff is maintaining a gap", "language problems" and "they don't understand our economic problems" which could be attributed to poor communication.

Reasons for avoiding the free health care service offered by government included, convenience (18 cases; 22.5 %), familiarity (40 cases; 50%), easy access (50 cases; 62.5%) and confidence on their family physician (8 cases; 10%).

Table 2 : Percentage of subjects expressed the different reasons for preferring the private sector

	MONTHLY INCOME		
Reason for preferring private sector	<25000 RS (< 191 USD)	25000-50000 Rs (191 – 382 USD)	>50000 rs (> 382 USD)
1	68%	52.4%	21.7%
1	68%	52.4%	21.7%
2	32%	38.0%	34.8%

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2	32%	38.0%	34.8%
3	40%	47.6%	73.9%
4	20%	42.8%	30.4%
5	0%	23.8%	30.4%
6	12%	0%	0%

1- Convenience; 2-Confidence on the private sector; 3- Familiarity; 4- Easy access; 5-Direct access to the consultant/specialist; 6-Other

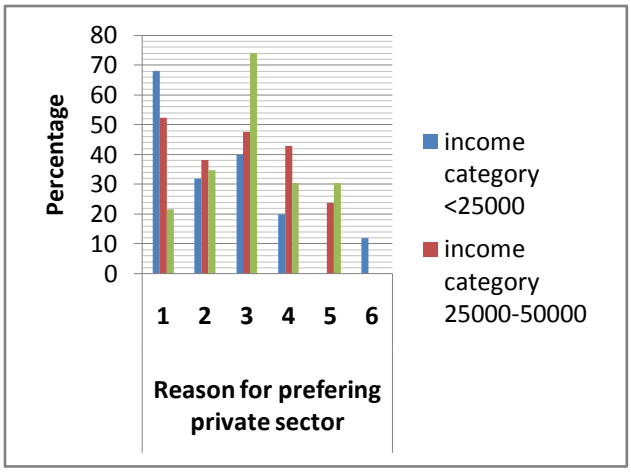


Figure 3 : Graphical representation of the percentage of patients in different economic categories, who had different reasons for preferring the private health sector

1- Convenience; 2-Confidence on the private sector; 3- Familiarity; 4- Easy access; 5-Direct access to the consultant/specialist; 6-Other

In response to the open ended questions they expressed their views as "the child showed a good response to the GP's medications last time", "the GP surgery is closer than the hospital", "last time the child showed no response after taking medication from the OPD several times" and "we have been used to going to that GP since the child was born"

Analysis of the degree of impact on patients' economic status indicated that, 41. 3% had compromised their savings, 44.8 % had taken loans for management of this illness.

IV. Discussion

Health care seeking behaviour causing escalation of out of pocket spending has been observed in many countries all over the world, at times even exceeding catastrophic levels leading to economic breakdown (Somkotra, 2009). Health care seeking be haviour is influenced by several factors; service availability, illness pattern, service policies like extent of private and public partnership, availability of alternate methods of spending such as insurance schemes, commercialization of health care services and public attitudes towards available services (Sri Lanka labour force survey,2013). Similarly, OOPS has definite impact on the economic stability as well as health status of the public that will in turn affect the entire nation (Sri Lanka labour force survey, 2013).

The choice of the majority of our sample (89%) has been the private sector in spite of the availability of free and reliable health care services delivered by the government. The country has a successful record of providing free health service over several decades. The public has the access to free health care delivery within a reach of 3 miles in any part of the country (Charlton, 2014). Currently one doctor serves1815 population (Census, 2006) and there are 157.3 nurses per 100,000 populations. Hospital bed density is 3.1 beds/1,000 populations (Census, 2004) (RAM commentary, 2008). The country has managed to progressively improve its records of satisfactory infant mortality rate, currently down to 8 deaths/1,000 live births (2010 census), maternal mortality rate down to 35 deaths/100,000 births (2014 census), and a life expectancy up to 74.1 years (2012 census) in the region [18], while maintaining the literacy ratio as high as 91.2%. (2010 census) that reaches closer to the standard of a developed country (RAM ratings,2008).Expression of their trust in existing system by the majority of the study sample would have been partly influenced by the study setting being a hospital and the presence of an interviewer who is representing the government hospital. Amongst all these facts, the reasons for the public approaching private sector in spite of financial difficulties are worth exploring.

Availability and efficiency of the private sector has been the reason for the gradual escalation of the

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spread of private health service. Since early 1980s with the introduction of open economic policies the government medical officers were allowed to engage in private practice after working hours and charge patients for their services (National health bulletin, 2008). This policy has led to initiation and expansion of the private health care services exponentially; resulting in expansion of consultation services, laboratory services and pharmacies.

The number of private hospitals has gone up from 44 in 1990 to 112 in 2011 [1].These institutions provide out-patient care to 419,000 in 1990 and to 6 million in 2011. Number of patients treated as inpatients in private hospitals has gone up from 65,000 in 2009 to 401,000 in 2011 (National Health Expenditure, 2011). This exponential growth of the private health sector has dragged in the deserted people without an easily accessible and convenient health service with direct access to the specialists.

The parallel economic growth of the country depicted by per capita income, Rs 18,912 in 1990 to Rs. 46,207 in 2014 has also diverted more people in to the private sector health services (National health bulletin, 2008). However the high economic growth of recent years has not, for the most part, reached the poor. Sri Lanka ranks 4th among Asian countries showing high economic inequality, based on the Gini-index of 46 in 1990 to 49 in 2014(National health bulletin, 2008). This indicates that a significant proportion of the population is probably not in a position to cope with expensive health care costs. Mainly the high-income groups are utilized still in-hospital services of the private sector, but the out-patient services are utilized by people of all income categories. (National health bulletin, 2008).

Lack of target population is contributing for perplexities of health care seeking be haviour of the public. Ambulatory care provided by public sector does not have a defined target population. Even the private sector, either by general practitioners or part time practicing government doctors, does not adhere to a target population. This culminates in improper planning or irregular follow up, repetition of investigate on sdue to deficiencies in proper record keeping, finally adding to OOPS. Cost of travelling and cost for investigations was the major contributor of OOPS in this study. How much of this travelling and investigations could be curtailed by rational use of health care services would be a valuable consideration.

Although the private health sector is on the rise, the prevailing referral system is unsatisfactory and the record keeping is not a mandatory requirement. On the other hand, the quality of the private health sector has not been properly monitored, which is very important in protecting the community from catastrophic outcomes. A study done in Thailand indicates that, the preference to use private sector healthcare services among wealthy families has made them more vulnerable to health related issues and disastrous spending than poor families (Somkotra T,2009)

Deficiencies in doctor patient communication could be attributed for unacceptable OOPS. As reflected by the responses to open ended questions, lack of confidence in the public sector, convenience, reliability and familiarity of their personal GP, suggest deficiencies of doctor- patient communication of the prevailing public health service. Traditional methods of doctor-patient communication style adopted by the majority of the government medical officers do not address patients' ideas, concerns, emotions and expectations. In a society with over 90% literacy ratio, patient cantered approaches and patient empowerment are valuable strategies to harness for better health of a nation.

Epidemics of dengue seem to have devastated our patients forcing them to seek health care in the private sector. However In the present study, only 6.25% of patients had sought medical advice in the private sector due to the fear of dengue.

Most of the parents in the study population expressed concerns about constraints on their economy caused by OOPS. This response is partly an expression of the mentality of people living in a society with a free health care service. However 26.25% of people have managed their illnesses with loans and some have pawned their jewellery. Reasons for this trend in a background of having free health care service is unclear. Reasons given for approaching private sector over free health care were convenience, easy access, familiarity and the confidence. However this opinion is probably biased due the presence of the interviewer, which became a confounding factor. Only a few had expressed serious concerns on lack of facilities, long waiting time and poor quality of the service in public health care service.

Sri Lanka is currently spending about 70 USD per capita for health care (Sri Lanka Health Accounts, 2011, 2005- 2009,). Health expenditure is 3.5% of GDP (Economic and Social Statistics of Sri Lanka, 2014) out of which Government of Sri Lanka spends 1.7% (Sri Lanka health accounts, 2011) of GDP for health care. Proper utilization of these public funds should bea high priority in health economic policies in the country.

V. Conclusions and Recommendations

This small study with limited power has demonstrated that the majority admitted to two hospitals in Sri Lanka, which has an established free health service, had selected private healthcare services prior to admission, incurring significant costs in comparison to their income. Such irrational health care behaviour could be attributed to deficiencies in doctor patient communication, lack of target population and deficiencies in the public health sector, for instance, lack of facilities, efficiency and difficulties in easy access.

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Making the state funded free healthcare service more patient centred, attractive and feasible would be beneficial to those who seem to struggle with the limited money they have. Best use of the existing private-public partnership could be achieved only if the public is making an informed decision on their health care spending. Further studies would be essential for detailed analysis of this timely problem and solutions, which will be beneficial for the individual patient as well as for the nation as a whole. Modifications of the organization of the existing health care system, including recognizing the definite target population, promoting patient centred approaches when practicing and teaching and training of competencies for government medical officers in order to win the trust of the general public will be useful in the long run.

VI. Limitations

The study sample does not represent the national population and the interviewer presence would have biased the opinion of participants.

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Media Reportage of the Ebola Crisis: Lessons from Nigeria

By Ben U. Nwanne

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Abstract- This paper focuses on the media reportage of the Ebola Virus Disease which has ravaged parts of West Africa, particularly Liberia, Sierra Leone and Guinea. Although the disease found its way into Nigeria through the Late Patrick Sawyer, Nigerian authorities quickly arrested the situation, for which they are getting well deserved commendations across the globe. The presentation derives its theoretical relevance from the agenda setting perspective which says that even though the media may not succeed in telling people what to think, they are stunningly successful in telling people what to think about. Information and perspectives were obtained from secondary sources of books, newspapers, magazines, and the electronic media. Interestingly, the research found a high success rate of communication efforts as it concerns the Ebola scourge, across cultural and geographical boundaries. The paper recommends among others, the immortalization of Late Dr. Stella Adadevoh for her sacrifice while ensuring that the war against Ebola is sustained through a further enhancement of public enlightenment.

Keywords: *mass media, crisis, credibility, public opinion.*

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Keywords: mass media, crisis, credibility, public opinion.

I. Introduction

Without a shred of doubt, one of the most devastating news items in the second half of the year 2014 has been the outbreak of the dreaded Ebola Virus Disease (EVD). Initially present in East Africa around the Congo River Region, the disease stealthily and devastatingly found its way into West Africa, ravaging Liberia, Sierra Leone, Guinea and to a lesser extent Nigeria.

Ordinarily, Nigeria would have been spared the unfortunate incident of the disease but for the wicked act of Dr. Patrick Sawyer, an Ebola patient form Liberia, a country that is gradually recovering from over a decade of a brutal civil war. The action of Sawyer put Nigeria on the dangerous map of Ebola. With the onset of the strange and deadly disease, many Nigerians were outraged, and panic momentarily took over. Indeed, no news had been as frightening as the outbreak of the disease which, experts say, has a high mortality rate of more than half of those infected. The bad news brought out the best in the media, both locally and internationally. They quickly rose up to their social responsibility of being the fourth estate of the realm. In this process, they discharged creditably and rapidly, their functions of surveillance of the society by unearthing potential and present dangers and pointing the way forward. The Nigeria government was also at its best in terms of providing leadership.

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II. Definition of Terms

It is natural, even desirable, to throw light on some expressions used in this presentation with a view to avoiding a measure of wooliness often associated with certain terms. For the purpose of this work, the following words/expressions will be defined. They include: mass media, crisis, credibility and public opinion.

a) Mass Media

Defleur and Dennis (1981, p.4) defines mass media as "devices for moving messages across distance or time to accomplish mass communication". On his part, Uyo (1987 p.1) concisely defines it as "path way or means" of reaching large, diversified audiences spread across geographical divides. Therefore, mass media are all the channels, avenues, opportunities of spreading mass communication messages. Over decades, even centuries, newspapers, magazines, radio, televisions and others have been deployed to achieve the purpose of reaching many persons almost simultaneously.

b) Crisis

According to Nasarinha (2009, p.192) a crisis is an unpredictable major threat that can have a negative effect on an organization, industry or stakeholders. The author further notes that a crisis has three broad features: (i) a crisis cannot be predicted, but it can be expected (one cannot say when it will occur); (ii) a major threat that has the potentials to disrupt organizational operations in some way (closure of production); and (iii) a crisis can threaten the organization, the industry or the stakeholders (Ajala, 2001).

In fact, any development which causes discomfort, loss of money, loss of good health and any other valuable possession, disruption of normal productive activity is definitely a crisis. Without doubt, therefore, the Ebola outbreak is a crisis of monumental proportions ravaging West Africa and threatening the entire human race.

c) Credibility

This is an important characteristic of the mass media. Uyo (1987) notes that credibility is not an innate

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characteristic of the media since it is earned through the performance of those who run the media. A medium that performs professionally and responsibly is likely to be believable, hence credible. For instance, in Nigeria, many government owned and run media suffer a low level of credibility on account of their clear partisanship and pro-government stance. On the other hand, many privately owned and run media such as **The Guardian**, **Vanguard**, and **The Punch** Newspapers e.tc. and Channels Television, African Independent Television (AIT) e.tc. enjoy a relatively high credibility rating among many readers and viewers in Nigeria.

d) Public Opinion

This an important concept in managing people. It deals with "aggregation of and expression of individual opinions about a public concern, expressed in such a manner as to be perceived by public decision makers" Blake and Harold son (1975, p.99). Quite often, issues of public opinion are somewhat fluid. But certain decisions, actions or in actions of those in government often touch the jugular of the people, prompting them to react in different ways. Any responsible and responsive government must devise an effective mechanism of monitoring and responding rapidly, to the heart-felt opinions of their people. This is inevitable because of the social contract between governments and their peoples.

III. Theoretical Framework

Theories and practices are like two sides of the same coin: complementary. An understanding and appreciation of theories is invariably necessary for effective practical applications. Given this scenario, the widely used agenda setting theory of the press is being explored as a theoretical basis for this presentation.

According to Folarin (2002, p.75):

Agenda setting implies that the mass media predetermine what issues are regarded as important at a given time in a given society. Agenda setting does not ascribe to the media the power to determine what we actually think; but it does ascribe to them the power to determine what we are thinking about.

This is indeed an important function of the mass media as they are saddled with the responsibility of putting on the table the issues of the day so that citizens may think about them. Being professionals, media people are able to present certain issues as being more urgent and of relatively high importance.

Indeed, every issue cannot rate equally in the estimation of the media. For instance, issues of insecurity are usually rated higher in importance as they are at the heart of peoples' survival. That obviously explains the huge airtime and newspaper and magazine space devoted to the problem of insurgency in North Eastern Nigeria, brutally orchestrated by the Boko Haram sect; and, of course, the onset of the dreaded Ebola Virus Disease.

In highlighting the important issues of the day, the media, according to Folarin (2002), employ such devices as the frequent reportage of certain news stories e.g. the placement and space allotted to such stories and the airtime, space and frequency of commentaries or editorials accompanying or following quickly on the heels of the stories.

IV. Media and Ebola

As previously stated, one of the most important functions of mass communication is surveillance of the environment to ensure safety of the people. After all, a society or community is all about the people who inhabit it. Therefore, every effort must be geared towards their safety and survival.

It was not therefore surprising that the mass media, locally and internationally, took up the gauntlet following the devastations unleashed by the onset of Ebola Virus Disease (EVD), popularly abbreviated as Ebola. On the local scene, the media reportage of the scourge was appropriately generous. Most of the stories received lead treatment in newspapers and magazines. A random sample of newspapers and magazines available to this researcher shows a generous devotion of space to Ebola related stories.

A sample will do at the juncture. In its front page lead story, **Sunday Vanguard** of August 31, 2014 reported: "Ebola: 39 foreigners held in Lagos." In its August 17, 2014 edition, **Sunday Vanguard** lead story was entitled: "Ebola Patient Discharged"; **Sunday Express** of August 24-30, 2014 front page story: "Ebola Scare: Top Actor, Van Vicker, flees location." **Sunday Sun** of August 17, 2014 led with a cheering story: "Ebola Miracle: Nigerian doctor Survives, Discharged from hospital, 4 others almost fully recovered. Sawyer's widow attacked for defending husband."

The proactive measure taken by the Federal Government of Nigeria was captured in a front page lead story: "Ebola Scare: FG shuts schools till October 13 published by **Vanguard** August 27, 2014; Summer Coaching in both public and privates schools affected; Adadevoh's Sister Ebola-free; Nigeria records 61.5% Survivors; don't stigmatize Ebola victims."

The media in Nigeria have appropriately celebrated the late Dr Stella Adadevoh, the senior medical officer at First Consultant Hospital Lagos where the index case was recorded. She had the professional responsibility of treating Dr. Patrick Sawyer, another name for disaster and insincerity. Dr Sawyer had lied that he had acute malaria according to media report. But an acutely professional Dr Adadevoh would not accept such explanation. She was determined to medically ascertain the illness that had knocked down the Liberian American. As if there was a grand

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conspiracy, many persons from different quarters brought pressure to bear on her to let the patient go. But she would not succumb to pressure. In order to see the case to its logical conclusion, the brave doctor had to contact the Lagos State Ministry of Health; a singular action that saved Nigeria from what is obviously one of the worst plagues of the 21st century. Given Nigeria's huge population, the public health disaster that would have resulted from a premature discharge of Dr. Sawyer would have been unimaginable.

Not unexpectedly, therefore, the media have appropriately canonized Dr Adadevoh for her sacrifice, having died from her primary contact with the cunning Dr Sawyer. The News Magazine, one of Nigeria's respected news magazines, in its September 1, 2014 edition, did a front page story on Adadevoh entitled "What you don't know about Dr Adadevoh". The magazine highlighted the action of Dr. Adadevoh, commending her exemplary courage, professionalism and patriotism.

Besides the effort of the local media in Nigeria, the international media have not relented in drawing attention to the epidemic which has posed a public health danger of utmost urgency to the entire humanity. The New York-based Cable News Network (CNN), like other media houses, has been in the fore front of reporting the devastating outcome of the Ebola virus. In its September 1, 2014 major news broadcast, "the world's news leaders", as it brands it self, did a heart-rending story of the ravages of Ebola in a Liberia village where many had died and the survivors in utter panic and total disarray. The news story showed clearly the terrible destruction of human lives caused by Ebola. The CNN reporter had gone with health officials to bury the remains of an Ebola victim. She was careful to put on the protective clothing of medical personnel!

Nobody else could come near; as the corpse was equally dangerous since the virus did not die with the victim. The entire village was desolate and the reporter managed to comport herself professionally despite the grave situation she found herself in. The situation was so bad that even Liberia's deputy health Minister, according to media reports, was put in quarantine on suspicion of being infected with the dreaded virus.

Apart from devoting substantial editorial space and airtime to the Ebola crisis, most media organizations have equally given attention to public enlightenment on how to safeguard people from being infected by the virus. The pay channel, DSTV, which is widely accessed in Africa by the elite, has a well illustrated public service announcement in which viewers are told how Ebola is contacted and what to do to avoid being endangered.

In Nigeria, many local media have also made commendable efforts to highlight the dangers of Ebola by providing relevant information. The Delta Broadcasting Service, Asaba and Warri, owned and operated by the Delta State Government, South South Nigeria, have translated the protect-yourself-against Ebola message into all the languages and dialects in the state to ensure reach and penetration.

V. Government Intervention in the Ebola Crisis in Nigeria

Following Dr Adadevoh's information to the Lagos State Ministry of Health, the Governor, Raji Fashola, went to work immediately, alerting the Federal Government. Displaying unusual commitment and professional savvy, both governments mobilized Nigeria's human and natural resources wisely and promptly, thereby averting what would have amounted to a disaster of monumental proportions, given that Nigeria is the largest concentration of black people on earth. Putting aside partisan politics and the base sentiments that have put Nigeria down for long, the Federal Government of Nigeria and Lagos State Government worked in rare harmony, achieving incredible results in the process. In a swift response, many Ebola screening and containment centres were constructed while the Lagos State Infectious Diseases Hospital in Yaba was quickly upgraded and become the epicenter of Ebola management and many persons suspected to have had any form of contact with the index case or secondary sources were promptly quarantined. After 21 days, being the incubation period of the virus, those who were free of the disease, were released while those found `guilty` were detained for further necessary action.

Providing rare leadership, the Federal Government through the supervision of the Minister of Health, Professor Onyebuchukwu Chukwu did the needful, injecting huge funds which were apparently well managed. The Ministry also deployed adequate public information machinery network to let residents know about the plague and the preventive measure which should be taken to prevent a spread of the disease. Government appropriately advised religious groups and others that have a proclivity for gathering crowds to stop forthwith while handshakes and other tactile activities were officially discouraged. Government information also advised improved personal hygiene by constantly washing hands with sanitizers or soap and running water. The Federal Government quickly understood and appreciated the enormity of the problem by promptly declaring Ebola a national emergency. Vanguard of August 7, 2014 gave the story a well deserved front page treatment and generous space in inside pages.

The public health hazard posed by the Ebola crisis must be the worst in the past few decades in the world, particularly in West Africa where over 3,000

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persons have been reported dead as at the last count. In Sierra Leone, Guinea and Liberia where the disease has assumed an epidemic proportion, the fear of Ebola appears to be the beginning of wisdom! With over one million people quarantined in Sierra Leone, according to media reports, no one needs be told that the crisis has assumed an agonizingly dangerous proportion.

As a proactive step, the Federal Government announced that primary and secondary schools in the country would resume on October 13, for the 2014/2015 academic session. The date was later reviewed and a new resumption date of September 22, 2014 was announced, an indication of the effective handling of the disease. Indeed, the fight against the dreaded Ebola virus Disease has been largely successful in Nigeria and for a long time, Nigeria government has a legitimate reason to congratulate itself even as it received accolades locally and internationally.

Notable among those praising the effort of the Nigeria Government is the United States of America. In a front page story entitled "US to Citizens: Nigeria contained Ebola; we can." The Guardian, and other newspapers, reported the US Government as getting inspiration from Nigeria on how to contain the disease. Encouraged by the success rate recorded by Nigeria, the United States of America had dispatched medical experts to study how Nigeria tamed Ebola. In a front page story, Vanguard of October 2, 2014, relying on statement from the US CDC director, Tom Frieden, reported inter alia that "Nigeria's extensive response to a single case of Ebola shows that control is possible with rapid, focused interventions." In the same vein, the October 20 certification of Nigeria as being completely Ebola free is a landmark in the fight against the deadly disease

This is significant for those who understand the usual relationship that often exists between the richer and poorer nations; the developed and developing nations, where the latter is always expected to look up to the former for financial aids and other forms of assistance. For once, this is a classical case of role reversal to the advantage of Nigeria and the developing world.

Doubtless, the management of Ebola scourge is a classical case of success of public health where different officials showed leadership at different levels. Speaking at a political event in Benin City, Edo State, Midwest Nigeria, Good luck Jonathan, Nigeria's President had observed that Nigeria had defeated the dread Ebola virus Disease, assuring that the success would be extended to the destruction of the equally dreaded Boko Haram sect, operating in Nigeria's North Eastern flank (The Guardian, September 28, 2014).

Nigeria's success in the fight against Ebola has been globally acknowledged with the mass media leading the cheer group. In the first two days of October 2014, the global media octopus CNN, aired special news and features on the Ebola crisis. The CNN quoted the Centre for Disease Control (CDC) in the US as commending Nigeria for effectively containing the Ebola scourge. According to the report, Nigeria achieved the high level of contact tracing with those who came in contact with Patrick Sawyer, the index case in Nigeria. The country's health officials were able to identify all those who had primary contact with him, isolated them for at least 21 days, being the incubation period of the disease. There is a near consensus that Nigeria seems to have shrugged off its general lethargy in handling issues of public concern as it displayed rare proactivity in effectively containing the Ebola challenge.

In drawing attention to the public health challenge posed by Ebola, the media, both local and international, have discharged their social responsibility obligation to humanity, the epicentre of any development effort. As Jefkins (1985 p. 63) has observed, "in literate industrial countries, the news media-press, radio and TV- are major vehicles for the widespread dissemination of PR information". They go further to unearth and disseminate information relating to the environment, public health and other issues of development generally."

While acknowledging the first rate handling of the Ebola problem by the Nigerian Government, public health managers have warned the authorities in Nigeria not to relent in their effort to completely eliminate any traces of Ebola in the country. An expert in health issue ' 's, and Executive Director of the United Nations Fund for Population Activities (UNFPA) Babatunde Oslumtimehin has advised Nigerian clinics and hospitals to desist from turning patients away because of fear of Ebola noting that such actions could lead to ethical concerns for medical doctors and poor health care for sick people.

VI. Communicating Across Cultural and Geographical Boundaries

It is a well known fact that communication is a basic human survival tool. In a local language adage in Nigeria, it is said that the stranger who is humble enough to ask is not likely to miss his way. The object of the enquiry is communication. Centuries ago, it took months of voyage to travel between continents. However, the invention of the airplane by the Wright Brothers has helped humanity move faster and more comfortably. In the area of information gathering and use, the introduction of the new media has been of immense benefit. This has been further enhanced with the triumphant 'arrival' of the information and technology facilities which have instant communication possibilities between places that are thousands of kilometers apart.

In Nigeria, viewers can monitor broadcasts of the British Broadcasting Cooperation (BBC) radio and Television signals, the CNN, the VOA and other world

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media within seconds. The Associated Press (AP), the Agence France Press (AFP), Reuters and other transnational news agencies are able to share news and pictures with readers and viewers across a news-hungry world. Verderber and Verderber (2008, p.102) were apparently referring to a similar situation when they wrote about the link between culture and communication. In their words:

How often have we heard people observe that the world is getting smaller and the people in it increasingly similar? Today, through the globalization of trade, the Internet and the World Wide Web, our lives are affected by the decisions and actions of people in other parts of the world and we can make instant personal contact with people around the globe through the click of a mouse.

Without doubt, the Ebola crisis which hit West Africa in year 2014 is a global issue, affecting the survival of the human race. It is not, therefore, surprising that international media have shown a professional interest in the challenge. Despite their diverse geographical locations, the foreign media are largely credible in developing countries. While it is easy to lay the blame of this on media imperialism, it is also wise to explore further by giving credit to the media of the industrialized countries for being technology-savvy to attain an edge over the media of the developing world.

According to Nwabueze (2014, p.47) "certain theories explain patterns of media exposure and content utilization" As for an media consumption is concerned, the uses and gratification has been found to be useful in contemporary media world because consumers are no longer docile consumers of media output, but active in selecting the materials that would gratify their needs.

VII. Summary

The outbreak of the dreaded Ebola Virus Disease is without doubt the most earth shaking public health news on account of its negative impact. The epicentre of the Ebola 'massacre' is West Africa, devastating Liberia, Sierra Leone and Guinea. Nigeria would have been part of the 'war zone' but for the proactive measures taken by government. In the process, the media, locally and internationally, also performed creditably their surveillance function.

In order to achieve a measure of conceptual clarity, such terms as mass media, crisis, public opinion and edibility have been defined, while the agenda setting theory provides a theoretical framework for the presentation.

In dealing with the Ebola challenge, the Government of Nigeria was proactive and clinically professional, thus saving the world what would have been a great humanitarian nightmare. Thus this action has, deservedly, earned the country global applause and commendation.

The local and international media have been forth coming in bringing the social problem to the attention of all, pointing the way forward.

VIII. Recommendations

Given the focus of this work which is the media report ape of the Ebola crisis and the efforts of the Nigerian Government to contain the spread, the following recommendations are put forward for consideration of those concerned.

1. The Nigerian Government should quickly bestow a posthumous national honour on the late Dr. Stella Adadevoh whose rare professionalism and patriotism in handling the index care in Nigeria of the Late Dr Patrick Sawyer, saved millions. Her personal sacrifice should be acknowledged by a grateful nation.
2. The leadership provided by the Nigeria Government must be sustained to ensure there is no pocket of 'Ebola resistance. It should also be extended to other segments of society.
3. All public institutions must be directed to have basic Ebola testing kits while government must provide the necessary infrastructure in handling the scourge.
4. Public enlightenment should be further strengthened by the media and other concerned groups or organizations with a view to keeping the disease at bay.

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Knowledge Regarding Sexually Transmitted Disease Amongst University Students in Pakistan

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Abstract- *Aims:* Sexually Transmitted Diseases are major global health concern. Their growing incidence can be a menace for any society from epidemiological and social aspect. This study investigated the current state of knowledge concerning sexually transmitted infections among Pakistani students.

Material and methods: This cross sectional study was conducted in four universities of Karachi, Pakistan, where inclusion criteria were university students, male or female of any age group. Ethical approval was taken prior to data collection.

Results: Overall 890 participants participated in the study with a response rate of 89%. Total 515 male and 375 female students were included in the study. 41.1 % males and 27.2 % of the female participants identified the sexually transmitted infections correctly from the list of given infections, while 0.9 % recognized the clinical signs of HIV/AIDS. 64.8% of the male and 60.2% of the female participants had apprehension regarding the risk factors of STI with M/F Odds of 1.07.

Keywords: *sexually transmitted diseases, HIV/AIDS, knowledge, students.*

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Conclusion: Students were inadequately knowledgeable regarding STIs. Control of STDs is the major factor governing the policies made by health care providers worldwide who strive to eliminate the prevalence of this disease. To reduce health disparities, health providers who have identified the male to female ratio in regards to their knowledge regarding STDs will be able to target the age groups at greatest risk.

Keywords: sexually transmitted diseases, HIV/AIDS, knowledge, students.

I. Introduction

Sexually transmitted infections (STIs) have been conventionally recognized as a major public and social health problem for a number of years now. [1] Largely because of the HIV epidemic, interest in STIs has increased over the past two decades.[2] It is the varying sociocultural and economic contexts in developing countries which largely influence the epidemiology of STIs and help to highlight the important public health priorities.

STIs are caused by more than 30 different bacteria, viruses and parasites and spread predominantly by sexual contact, including vaginal, anal and oral sex, however, organisms causing STIs can also be spread through non-sexual means such as blood products and tissue transfer. Many STIs—including chlamydia, gonorrhea, hepatitis B, HIV, Human papilloma virus, Herpes simplex virus and syphilis can be vertically transmitted from mother to child. An infected person can be asymptomatic; therefore, the term "sexually transmitted infection" is a broader term than "sexually transmitted disease" (STD). Common symptoms of STDs include vaginal discharge, urethral discharge in men, genital ulcers, and abdominal pain.[3]

Eight of the more than 30 pathogens known to be transmitted through sexual contact have been linked to the greatest incidence of illness, of these eight infections, four are currently curable: syphilis, gonorrhea, chlamydia and trichomoniasis. The other four are viral infections and known to be incurable, however can be mitigated or modulated through treatment: hepatitis B, herpes, HIV, and HPV.[3]

According to the World Health Report , STIs excluding HIV accounted for 1.2% disability adjusted life years (DALYs) during 1998; 0.8% among males and 1.7% among females..4 The World Bank has estimated that STIs altogether rank second in importance among diseases for which intervention is possible[4]

And that four curable STIs; gonorrhoea, chlamydial infection, syphilis and chancroid rank among the top 25 causes of healthy days of life lost in sub-Saharan Africa. Epidemiological studies from sub-Saharan Africa, Europe and North America indicate that there is approximately four times greater risk of becoming HIV-infected in the presence of a genital ulcer such as caused by herpes and other sexually transmitted diseases; and a significantly, increased risk in the presence of STIs such as go norrhoea, chlamydial infection and trichomoniasis, which cause local accumulations of lymphocytes and macrophages. [5]

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The importance regarding awareness of STIs amongst the students in Pakistan varies within the age group of 20-29 themselves on religious, ethnic and social grounds. School education, peer groups and mass media remain the main stream ways by which students learn about STDs. However, parents play a crucial role in the education of female students about sexual matters.[6, 7]

STIs have had a serious global impact. In recent years untreated maternal syphilis accounts for highest STI-related mortality regardless of age. Globally, 2.1 million pregnant women are infected with syphilis annually and an estimated 6.2% of neonatal deaths and 9.7% of stillbirths are caused by untreated maternal syphilis.[8]

The aim of this study was to highlight the knowledge of university students regarding STIs and to study contribute to the scant data available on this issue in Pakistan.

II. Methods

This cross sectional study was conducted at four universities in the city of Karachi, Pakistan. Convenient cluster sampling was done. Oral and written consent was obtained from all students before participating in the study. The knowledge regarding sexually transmitted diseases of the students was evaluated by self-administered questionnaire. Inclusion criteria included all university students, no gender or age restriction was applied to be inclusive in the study. Ethical approval was obtained from the board of ethics of all four universities.

Students were asked various questions with a special focus on risk factors, transmission, prevention and source of information regarding sexually transmitted diseases.

Data entry and analysis was done in Statistical Package for Social Sciences (SPSS) version 17.

III. Results

This study initially recruited 1000 participants however 890 participants stayed in the study with a response rate of 89%. Total 515 male and 375 female students participated in the study. There were 677 students in the age range between 20-24 years and 213 in 25-29 years. (Table 1)

Table 1: Demographics Of The Participants

Age group	Male	Female	Total
20-24	376	301	677
25-29	139	74	213
	515	375	890

Overall 41.1 % males and 27.2 % of the female participants identified the sexually transmitted infections from the list of infections with a M/F Odds ratio of 1.5(C.I: 0.03--1.77). Regarding sign and symptoms of HIV/AIDS, 24.5% and 26.4% of males and female student respectively M/F Odds: 0.9(C.I:0.02--1.71) recognized the clinical signs of HIV/AIDS. 64.8% of the male and 60.2% of the female participants were well aware of the risk factors of STI with M/F Odds of 1.07. More male (62.3%) than female (54.1%) knew the route of transmission of STIs while 75.5 % of males and 85.3% of the females had the understanding of preventive methods for STI with an Odds M/F: 0.88(C.I: 0.25-1.59). (Table 2)

Table 2 : Knowledge Regarding Sti In Students

questions	Male (%)	Female (%)	M/F OR (95% C.I)
Examples of STI	212(41.1)	102(27.2)	1.5 (0.03--1.77)
Signs and Symptoms of HIV/AIDS	126(24.5)	99(26.4)	0.9(0.02--1.71)
Risk factors for STD	334(64.8)	226(60.2)	1.07(0.51—0.9)
Route of STIs	321(62.3)	203(54.1)	1.15(0.28-3.10)
Prevention of STDs	389(75.5)	320(85.3)	0.88(0.25-1.59)

M/F OR (95% C.I): Male/ Female Odds Ratio (95% Confidence Interval)

The main source of information regarding STI for students was internet where 49% of male and 25.8 % of the female participants access it for the required information. The second most frequent source was 'television' for males (14.2%) while for female participants it was 'parents and family '(24.8%). (Table 3)

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Table 3: Most Common Source Of Information

SOURCES	MALE (%)	FEMALE (%)	M/F OR (95% C.I)
TELEVISION	73(14.2)	63(16.8)	0.84(0.79--8.71)
INTERNET	252(49)	97(25.8)	1.89(1.47--111.1)
RADIO	6(1.1)	2(0.5)	2.2 (1.1—14.2)
PRINT MEDIA	55(10.6)	53(14.1)	0.75(0.13-1.28)
PARENTS/FAMILY	42(8.1)	93(24.8)	0.32(1.43--8.62)
FRIENDS	61(11.8)	57(15.2)	0.77(0.08--0.47)
OTHERS	20(3.9)	10(2.6)	1.5(0.56—3.8)

IV. Discussion

Several Comprehensive studies have highlighted the growing prevalence of STIs in Pakistan in the recent years. In a study conducted to measure the prevalence of STIs amongst the urban men in Pakistan, concluded that, city-wise, the highest prevalence of STIs was in Karachi (8.5%) followed by Lahore (5.3%), Faisalabad (4.0%) Quetta (4.3%), Rawalpindi (2.5%) and Peshawar (2.0%). [9] In another study, conducted in Faisalabad, Syphilis emerged as the most prevalent STI in Pakistan. [10]The findings of this study indicated that knowledge regarding STIs was inadequate among adolescent girls. Out of 375 girls, more male (62.3%) than female (54.1%) knew about the route of transmission of STIs. This is of particular concern in developing countries like India , as STIs such as Chlamydia, Trichomoniasis, Syphilis and Gonorrhea are second only to maternal morbidity and mortality as the cause of death, illness and 'years of healthy life lost' among women in their child bearing years.[11]

Comparison of findings, between the two studies is difficult as there is limited studies conducted in India and Pakistan investigating the STI knowledge (other than HIV/AIDs) of adolescent girls. More than one third of students in the study conducted in India had scares understanding about the signs and symptoms of STIs. A study with was conducted by Lal et. al., in Kerala showed that college students had 34% awareness of the symptoms of STIs. [12]

Attitudes, norms and motivational factors are of paramount importance in the decision making process of adolescents regarding engaging in risky behaviors.[13]

Electronic and social media remains an influential mean of knowledge transfer throughout the globe. Online information is widely accessable to students and provides an effctive medium to approach the target popullation. This study showed that the most common sourse of information for students regarding STI was internet followed by television and parents/family. Results of a study by standfortetal demo strated that the students were extensively aware of a STI through television advertisements however they preffered to achieve knowledge regarding sexual health from a physician. The high impact and importance of timely education through media and online material is undisputable and should be highly considered in popullations with scant knowledge regarding STI. [14]

In order to intensify the focus on STI prevention among young people, the Government of Pakistan should announce the underway National Education Program whose main focus is to raise sexual reproductive health issues, gender and life skills.

Educating adults and children is not only essential under these non-regulated conditions but also vital in order to brief them regarding potentially critical health issues they might face.

V. Conclusion

The study achieved to draw an insight of STIs knowledge in university students. The overall knowledge of the students was found to be deficient on some aspects of STI. There were different influential factors which helped enhance this knowledge. This was a key study which could help health providers identify the role of media in imparting sexual education amongst the youth of this country and could later be targeted to improve the health care practices in our country.

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Nutritional Quality and Health Benefits of Okra *(Abelmoschus Esculentus)*: A Review

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Keywords: *okra, nutritional, quality, health, edible, oil.*

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NUTRITIONALQUALITYANDHEALTHBENEFITSOFOKRAABELMOSCHUSESCULENTUSAREVIEW

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Nutritional Quality and Health Benefits of Okra *(Abelmoschus Esculentus)*: A Review

Habtamu Fekadu Gemede [α], Negussie Ratta [σ], Gulelat Desse Haki [ρ] & Ashagrie Z. Woldegiorgis [ω]

Abstract- Okra *(Abelmoschus esculentus)* is an economically important vegetable crop grown in tropical and sub-tropical parts of the world. This paper was aimed to review nutritional quality and potential health benefits of edible parts of Okra. Okra is a multipurpose crop due to its various uses of the fresh leaves, buds, flowers, pods, stems and seeds. Okra immature fruits, which are consumed as vegetables, can be used in salads, soups and stews, fresh or dried, fried or boiled. It offers mucilaginous consistency after cooking. Often the extract obtained from the fruit is added to different recipes like stews and sauces to increase the consistency. Okra mucilage has medicinal applications when used as a plasma replacement or blood volume expander. The mucilage of okra binds cholesterol and bile acid carrying toxins dumped into it by the liver. Okra seeds are a potential source of oil, with concentrations varying from 20% to 40%, which consists of linoleic acid up to 47.4%. Okra seed oil is also a rich source of linoleic acid, a polyunsaturated fatty acid essential for human nutrition. Okra has been called "a perfect villager's vegetable" because of its robust nature, dietary fiber, and distinct seed protein balance of both lysine and tryptophan amino acids. The amino acid composition of okra seed protein is comparable to that of soybean and the protein efficiency ratio is higher than that of soybean and the amino acid pattern of the protein renders it an adequate supplement to legume or cereal based diets. Okra seed is known to be rich in high quality protein especially with regards to its content of essential amino acids relative to other plant protein sources. Okra is a powerhouse of valuable nutrients, nearly half of which is soluble fibre in the form of gums and pectins which help to lower serum cholesterol, reducing the risk of heart diseases. The other fraction of Okra is insoluble fibre, which helps to keep the intestinal tract healthy. Okra is also abundant with several carbohydrates, minerals and vitamins, which plays a vital role in human diet and health. Okra is rich in phenolic compounds with important biological properties like quartering and flavonol derivatives, catechin oligomers and hydroxycinnamic derivatives. Okra is also known for being high in antioxidants activity. Okra has several potential health beneficial effects on some of the important human diseases like cardiovascular disease, type 2 diabetes, digestive diseases and some cancers. Overall, Okra is an important vegetable crop with a diverse array of nutritional quality and potential health benefits.

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Keywords: okra, nutritional, quality, health, edible, oil.

I. Introduction

Okra *(Abelmoschus esculentus)* is one of the most widely known and utilized species of the family Malvaceae (Naveed *et al.,* 2009) and an economically important vegetable crop grown in tropical and sub-tropical parts of the world (Oyelade et al., 2003; Andras et al., 2005; Saifullah & Rabbani, 2009). This crop is one of the most widely known and utilized species of the family Malvaceae (Naveed et al., 2009). Okra plant was previously included in the genus Hibiscus. Later, it was designated to Abelmoschus, which is distinguished from the genus Hibiscus (Aladele *et al.* 2008).

Okra originated in Ethiopia (Simmone *et al.,* 2004; Sathish & Eswar, 2013; Getachew, 2001; Dandena, 2010) and was then propagated in North Africa, in the Mediterranean, in Arabia and India by the 12th century BC (Nzikou *et al.,* 2006). Considering the little contact between Ethiopia and the rest of the world within historic times, it is not surprising that little is known about the early history and distribution of okra. The routes by which okra was taken from Ethiopia to North Africa, the eastern Mediterranean, Arabia, and India, and when, are by no means certain (Tindall, 1983).

Okra is known by many local names in different parts of the world. It is called lady's finger in England, gumbo in the United States of America, guino-gombo in Spanish, guibeiro in Portuguese and bhindiin India (Ndunguru & Rajabu, 2004; Sorapong Benchasr, 2012). In its origin of Ethiopia it is also called Kenkase (Berta), Andeha (Gumuz), Bamia (Oromica/Amharic). The name Okra probably derives from one of Niger-Congo group of languages (the name for okra in the Twi language is nkuruma) (Benjawan *et al.,* 2007). The term okra was in the use of English by the late 18th century (Arapitsas, 2008).

Okra is suitable for cultivation as a garden crop as well as on large commercial farms (Rubatzky & Yamaguchi, 1997). Okra plants are grown commercially in many countries such as India, Japan, Turkey, Iran, Western Africa, Yugoslavia, Bangladesh, Afghanistan, Pakistan, Myanmar, Malaysia, Thailand, India, Brazil, Ethiopia, Cyprus and in the Southern United States (Qhureshi, 2007).

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Okra is a multipurpose crop due to its various uses of the fresh leaves, buds, flowers, pods, stems and seeds (Mihretu *et al.,* 2014). Okra immature fruits (green seed pods), which are consumed as vegetables, can be used in salads, soups and stews, fresh or dried, fried or boiled (Ndunguru & Rajabu, 2004). It offers mucilaginous consistency after cooking. Often the extract obtained from the fruit is added to different recipes like soups, stews and sauces to increase the consistency. Okra mucilage has medicinal applications when used as a plasma replacement or blood volume expander. The mucilage of okra binds cholesterol and bile acid carrying toxins dumped into it by the liver. The immature pods are also used in making pickle. The entire plant is edible and is used to have several food (Madison, 2008; Maramag, 2013).

Okra seeds are source of oil and protein. Okra seeds have been used on a small scale for oil production. It can be also used as non-caffeinated substitute for coffee. Okra seeds may be roasted and ground to form a caffeine-free substitute for coffee (Calisir, & Yildiz, 2005). Okra also has industrial applications and is used in confectionary (Adetuyi *et al.,* 2011). To promote the use of indigenous vegetables like Okra that have play significant role in mitigate food insecurity and alleviate malnutrition in the country. However, Okra has been considered a minor crop and no attention was paid to its improvement in the international research program in past (Sanjeet *et al.,* 2010).

On the other hand, the demand for vegetable oils is rapidly increasing due to the growing human population and the expanding oil industry with health promoting oil components, the exploration of some underutilized and newer resources of vegetable oils is of much concern (Schalau, 2002). Okra, which is currently grown mainly as a vegetable crop, has potential for cultivation as an essential oilseed crop because okra seeds contain high amount of oil (20-40%) (Sorapong, 2012; MEF, 2013). However, there is also no comprehensive literature information regarding characteristics of the oils produced from Okra seeds. Therefore, this review was aimed to assess literature regarding the nutritional quality and potential health benefits of edible parts of Okra *(Abelmoschus esculentus)* vegetable. The oil compositions of okra seed was also discussed in order to provide further reliable information about health promoting oil components of Okra seeds.

II. Nutritional Composition of Okra

Okra is more a diet food than staple (National Research Council, 2006). Okra seeds have been used on a small scale for oil production. Lipid components greatly contribute to the nutritional and sensory value of almost all types of foods. Nature provides a large number of fats that differ in their chemical and functional properties. Four classes of lipids are habitually found in vegetable oils: triacylglycerols, diacylglycerols, polar lipids, and free fatty acids. The fatty acid composition determines the physical properties, stability, and nutritional value of lipids. The most naturally occurring storage lipids are triacylglycerols. Triacylglycerols are natural compounds that consist of saturated and unsaturated fatty acids that differ in the length of their acyl chains and the number and positions of double bonds: saturated, monoenoic, and polyunsaturated fatty acids that differ with respect to detailed fatty acid composition. Monoenoic fatty acids and polyunsaturated fatty acids are structurally distinguished by the presence of repeating methylene units. These units produce an extremely flexible chain that rapidly reorients through conformational states and constitutes an influential group of molecules that promote health (Vermerris & Nicholson, 2006). Okra seeds from Greece are a potential source of oil, with concentrations varying from 20% to 40% (Sorapong, 2012; MEF, 2013), depending on the extraction method. The oil mainly consists of linoleic acid (up to 47.4%) (Andras *et al.,* 2005) . Okra seed oil is a rich source of linoleic acid, a polyunsaturated fatty acid essential for human nutrition (Savello *et al.,* 1980).

Proteins play a particularly important role in human nutrition. The amino acid contents, proportions, and their digestibility by humans characterize a protein's biological value (Ewa, 2011). Okra has been called "a perfect villager's vegetable" because of its robust nature, dietary fiber, and distinct seed protein balance of both lysine and tryptophan amino acids (unlike the proteins of cereals and pulses) (Holser & Bost, 2004; Sanjeet *et al.,* 2010). The amino acid composition of okra seed protein is comparable to that of soybean and the PER is higher than that of soybean (Adetuyi *et al.,* 2012) and the amino acid pattern of the protein renders it an adequate supplement to legume or cereal based diets (Ndangui *et al.,* 2010). Okra seed is known to be rich in high quality protein especially with regards to its content of essential amino acids relative to other plant protein sources (Oyelade *et al.,* 2003; National Academic Council, 2006). Hence, it plays a vital role in the human diet (Farinde *et al.,* 2007).

Okra also contains carbohydrates and vitamins (Owolarafe & Shotonde 2004, Gopalan et al. 2007, Arapitsas, 2008, Dilruba *et al.,* 2009), and plays a vital role in human diet (Kahlon *et al.,* 2007, Saifullah & Rabbani, 2009). Consumption of young immature okra pods is important as fresh fruits, and it can be consumed in different forms (Ndunguru & Rajabu, 2004). Fruits can be boiled, fried or cooked (Akintoye *et al.,* 2011). The composition of okra pods per 100 g edible portion (81% of the product as purchased, ends trimmed) is: water 88.6 g, energy 144.00 kJ (36 kcal),

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protein 2.10 g, carbohydrate 8.20 g, fat 0.20 g, fibre 1.70 g, Ca 84.00 mg, P 90.00 mg, Fe 1.20 mg, β-carotene 185.00 µg, riboflavin 0.08 mg, thiamin 0.04 mg, niacin 0.60 mg, ascorbic acid 47.00 mg.

The composition of okra leaves per 100 g edible portion is: water 81.50 g, energy 235.00 kJ (56.00 kcal), protein 4.40 g, fat 0.60 g, carbohydrate 11.30 g, fibre 2.10 g, Ca 532.00 mg, P 70.00 mg, Fe 0.70 mg, ascorbic acid 59.00 mg, β-carotene 385.00 µg, thiamin 0.25 mg, riboflavin 2.80 mg, niacin 0.20 mg (Gopalan *et al.,* 2007, Varmudy, 2011). Carbohydrates are mainly present in the form of mucilage (Liu et al., 2005, Kumar et al., 2009). That of young fruits consists of long chain molecules with a molecular weight of about 170,000 made up of sugar units and amino acids. The main components are galactose (25%), rhamnose (22%), galacturonic acid (27%) and amino acids (11%). The mucilage is highly soluble in water. Its solution in water has an intrinsic viscosity value of about 30%.

Potassium, Sodium, Magnesium and Calcium are the principal elements in pods, which contain about 17% seeds. Presence of Iron, Zink, Manganese and Nickel also has been reported (Moyin-Jesu, 2007)38. Fresh pods are low in calories (20 per 100 g), practically no fat, high in fiber, and have several valuable nutrients, including about 30% of the recommended levels of vitamin C (16 to 29 mg), 10 to 20% of folate (46 to 88 mg) and about 5% of vitamin A (14 to 20 RAE). Both pod skin (mesocarp) and seeds are excellent source of zinc (80 mg/g) (Cook *et al.,* 2000).

Okra seed is mainly composed of oligomeric catechins (2.5 mg/g of seeds) and flavonol derivatives (3.4 mg/g of seeds), while the mesocarp is mainly composed of hydroxycinnamic and quercetin derivatives (0.2 and 0.3 mg/g of skins). Pods and seeds are rich in phenolic compounds with important biological properties like quartering derivatives, catechin oligomers and hydroxycinnamic derivatives (Arapitsas, 2008). These properties, along with the high content of carbohydrates, proteins, glycol-protein, and other dietary elements enhance the importance of this foodstuff in the human diet (Manach *et al.,* 2005; Arapitsas, 2008).

Dried okra sauce (pods mixed with other ingredients and regularly consumed in West Africa) does not provide any beta carotene (vitamin A) or retinol (Avallone *et al.,* 2008). However, fresh okra pods are the most important vegetable source of viscous fiber, an important dietary component to lower cholesterol (Kendall & Jenkins, 2004). Seven-days-old fresh okra pods have the highest concentration of nutrients (Agbo *et al.,* 2008).

III. Seed as Potential Edible Oil and Flour Source

Okra seeds contain about 20 to 40% oil (Sorapong Benchasr, 2012; MEF, 2013). The bark fibre is easy to extract. It is white to yellow in colour, strong but rather coarse. Tests conducted in China suggest that an alcohol extract of okra leaves can eliminate oxygen free radicals, alleviate renal tubular-interstitial diseases, reduce proteinuria, and improve renal function (Liu et al., 2005; Kumar *et al.,* 2009). Okra seed can be dried, and the dried seeds are a nutritious material that can be used to prepare vegetable curds, or roasted and ground to be used as coffee additive or substitute (Moekchantuk & Kumar, 2004).

Okra seed oil yield is comparable to most oil seed crops except oil palm and soybean (Sanjeet *et al.,* 2010). Moreover, okra seed oil has potential hypocholesterolemic effect. The potential for wide cultivation of okra for edible oil as well as for cake is very high (Sanjeet *et al.,* 2010). Okra seed flour could also be used to fortify cereal flour (Adelakun *et al.,* 2008). For example, supplementing maize ogi with okra meal increases protein, ash, oil and fiber content (Akingbala et al., 2003). Okra seed flour has been used to supplement corn flour for a very long time in countries like Egypt to make better quality dough. However, long-term rodent/animal feeding trials would be pertinent before making final recommendations for wider consumption of okra seed flour (Sanjeet *et al.,* 2010).

The enormous nutritional and other biological activities in the pods and seeds were reported by Agbo *et al.,* (2008), Arapitsas, (2008) and Kumar et al., (2010). The okra pods were reported to have viscous fiber and lower cholesterol content (Kumar et al., 2010; Kendall & Jenkins, 2004). Okra seeds were determined to have appreciable protein content according to *Akingbala et al.,* (2003). The variations in polysaccharides found in the mucilage are higher in okra pods according to Hirose et al., (2004) and Sengkhamparn *et al.,* (2009).

Green vegetables contain valuable chlorophyll (Ebermann *et al.,* 2006). Chlorophyllin as an important component of chlorophyll was reported for enormous health benefits. The physiological and biochemical activities of phenolic compounds as antioxidant, anti-inflammatory and anti-microbial were also reported by Ali and Deokule, (2008); Manach *et al.,* (2005) and Middleton, (2000). Marinova *et al.,* (2005) proved the higher values of phenolic and flavonoid values, ratios and distributions in some Bulgarian vegetables and fruits. Generally, fruits and vegetables have shown the basic useful properties especially in providing an excellent health and nutritional qualities in the area of prevention and delay in the onset of chronic diseases and the provision of

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vitamins and enzymes necessary for proper body function (Aman *et al.,* 2005).

IV. Mucilage and its Potential

Okra mucilage refers to the thick and slimy substance found in fresh as well as dried pods. Mucilaginous substances are usually concentrated in the pod walls and are chemically acidic polysaccharides associated with proteins and minerals (Woolfe *et al.,* 1977). Although nature of the polysaccharides varies greatly, neutral sugars rhamnose, galactose and galacturonic acid have been reported often (Hirose *et al.,* 2004; Sengkhamparn *et al.,* 2009). The okra mucilage can be extracted as a viscous gum using various procedures. Such diversity in the extraction procedures seems to contribute to the observed variability in the mucilage chemical composition (Ndjouenkeu *et al.,* 1996). Okra mucilage is a renewable and inexpensive source of biodegradable material. Its physical and chemical properties include high water solubility, plasticity, elasticity and viscosity (Be Miller *et al.,* 1993).

Most physical and chemical properties are influenced by factors such as temperature, pH, sugar and salt contents, and storage time (Woolfe *et al.,* 1977; Baht & Tharanathan, 1987). Okra mucilage has potential for use as food, non-food products, and medicine. Food applications include use as a whipping agent for reconstituted egg whites, as an additive in the formulation of flour-based adhesives, and as an additive in India for clarifying sugarcane juice. Non-food applications include brightening agents in electro deposition of metals, as a deflocculant in paper and fabric production, and as a protectant to reduce friction in pipe-flow (Be Miller *et al.,* 1993; Ndjouenkeu *et al.,* 1996). Polysaccharides can be combined with acrylamide to develop new biodegradable polymeric materials (Mishra *et al.,* 2008). Potential of mucilage for medicinal applications includes uses as an extender of serum albumin (Be Miller *et al.,* 1993), as tablet binder (Ofoefule *et al.,* 2001) and as suspending agent in formulations (Kumar *et al.,* 2009). Okra mucilage is used in Asian medicine as a protective food additive against irritating and inflammatory gastric diseases (Lengsfelf *et al.,* 2004).

V. Health Benefits of Okra

In recent years, increasing attention has been paid to the role of diet in human health (Ohr, 2004). The high intake of plant products is associated with a reduced risk of a number of chronic diseases, such as atherosclerosis and cancer (Gosslau & Chen, 2004). These beneficial effects have been partly attributed to the compounds which possess antioxidant activity. The major antioxidants of vegetables are vitamins C and E, carotenoids, and phenolic compounds, especially flavonoids. These antioxidants scavenge radicals and inhibit the chain initiation or break the chain propagation (the second defense line). Vitamin E and carotenoids also contribute to the first defense line against oxidative stress, because they quench singlet oxygen (Krinsky, 2001). Flavonoids as well as vitamin C showed a protective activity to α-atocopherol in human LDL, and they can also regenerate vitamin E, from the α-chromanoxy radical (Davey *et al.,* 2000).

Nutrient antioxidants may act together to reduce reactive oxygen spieces level more effectively than single dietary antioxidants, because they can function as synergists (Rossetto *et al.,* 2002). In addition, a mixture containing both water-soluble and lipid-soluble antioxidants is capable of quenching free radicals in both aqueous and lipid phases (Trombino *et al.,* 2004). For example, with the liposome oxidation method, the activity of combination of quercetin or catechins plus α-tocopherol was significantly higher than the sum of the individual activities. Combinations of α-tocopherol or vitamin C plus phenolic compounds also provided synergistic effects in human erythrocyte membrane ghosts and phosphatidylcholine liposome systems (Liao & Yin, 2000).

Okra seed is rich in protein and unsaturated fatty acids such as linoleic acid (Oyelade *et al.,* 2003). In some countries, okra also is used in folk medicine as antiulcerogenic, gastroprotective, diuretic agents (Gurbuz, 2003). However, little information on antioxidant capabilities of major phenolic compounds from okra seed is available. Okra is also a popular health food due to its high fiber, vitamin C, and folate content. Okra is also a good source of calcium and potassium. Okra pod contains thick slimy polysaccharides, which are used to thicken soups and stews, as an egg white substitute, and as a fat substitute in chocolate bar cookies and in chocolate frozen dairy dessert (Sengkhamparn *et al.,* 2009).

Okra is also known for being high in antioxidants activity with different parts of the plant (Shui & Peng, 2004). Atawodi *et al.,* (2009) has reported in vitro antioxidant assay of methanol extract of okra fruits. They have done antioxidant/radical scavenging activities by xanthine oxidase and 2-deoxyguanosine methods and reported 50% inhibitory concentration values of 25 and 43 ml. In addition, Arapitsas, (2008) reported that Okra seed is rich in Phenolic compounds, mainly composed of flavonol derivatives and oligomeric catechins. According to Khomsug *et al.,* (2010), total phenolic content of pulped and seeds of okra extracts as 10.75±0.02mg GAE/100g extract and 142.48±0.02mg GAE/100g extract which corresponds with scavenging activities. Besides they have also found procycanidin B2 as predominant phenolic compound followed by procycanidin B1 and rutin in seeds. In pulped seed catechin, procycanidin B2,

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epicatechin and rutin are reported to be present. It is quite important to the see that roasting (1600°C for 10–60 minutes) increased the nutrient composition and antioxidant activity of the seeds whereas pre-treatment (soaking and blanching) increased the nutrient composition, but decreases antioxidant activity (Adelakun *et al.,* 2010). Ansari, (2005) reported Okra extract as in vitronon-enzymatic inhibitior of lipid peroxidation in liposomes. A. esculentus peel and seed powder contains significant in vivo antioxidant property in streptozotocin-induced diabetic rats.

Administration of different doses of peel and seed powder significantly increased liver, kidney and pancreas superoxide dismutase, catalase, glutathione peroxidase, reduced glutathione levels and decreased thiobarbituric acid reactive substances (TBARS) ($P < 0.001$) levels in diabetic rats compared to diabetic control rats. Liao *et al.,* (2012) has done a comparative analysis of total phenolics and total flavonoids and antioxidant ability of different organs (flower, fruit, leaf, and seed) and different enrichment fractions of water extracts of the A. esculentus plant. They confirmed fruitful presence of total phenolics and total flavonoids related to antioxidant ability in all the extracts of the plant organs although percentage varied. In flower of okra highest amount of total phenolics and totalflavonoids were found (Liao *et al.,* 2012). This data suggests Okra as a good contributor to the antioxidant status and promising chemopreventive agent as described in several traditional medicines for human race. Okra is abundant with several vitamins, minerals, and nutrients that handles the health advantages the plant provides. Here are a few of okra's health advantages

Okr contain high fiber, which "helps to stabilize blood sugar by regulating the rate at which sugar is absorbed from the intestinal tract". Because of fiber along with other nutrition, okra shows useful for minimizing blood sugar levels within the body, assisting along with diabetes. The fiber likewise helps support blood sugar levels level simply by slowing down sugar assimilation through the intestines (Ngoc *et al.,* 2008). The frequent usage of okra might help avoid kidney disease. Within the research, "those who consumed okra every day decreased clinical indications of kidney damage a lot more than the ones that simply consumed a diabetic diet." This ties along with diabetes, as almost 50% of kidney disease cases are generated by diabetes (Lengsfeld *et al.,* 2004).

Okra is used to to treat digestive issues. The polysaccharides present in immature okra pods possessed considerable antiadhesive properties (i.e. they help remove the adhesive between bacteria and stomach tissue, preventing the cultures from spreading). Okra's polysaccharides were particularly effective at inhibiting the adhesion of *Helicobacter pylori,* a bacterium that dwells in the stomach and can cause gastritis and gastric ulcers if left unchecked. Therefore, eating more okra can keep our stomach clean and create an environment that prevents destructive cultures from flourishing (Messing *et al.,* 2014). Okra is used to supports colon health. It smoothly sails down our colon, absorbing all toxins and excess water in its path. Okra is filled with dietary fiber,that is required for colon health and digestive health all together. The fiber Okra offers helps to cleanse the intestinal system, letting the colon to operate at higher amounts of effectiveness. In addition, the vitamin A plays a role in wholesome mucous membranes, assisting the digestive system to function adequately (Georgiadisa *et al.,* 2011).

Okra is used to promotes healthy skin and blood. One hundred grams of okra also contain approximately 27 percent of our RDI of vitamin C and 50 percent of our RDI of vitamin K. Vitamin C is, of course, an essential antioxidant that aids in the growth and repair of bodily tissues. For this reason, eating more okra can rejuvenate our skin and hair, and also shield us from degenerative diseases associated with long-term free radical damage. Vitamin K, on the other hand, plays an important role in blood clot formation. If you suffer from regular nosebleeds, bleeding gums, heavy menstrual bleeding, or easy bruising, your blood might be too thin. Consider adding more vitamin K-rich foods like okra to your diet to improve your blood's ability to coagulate (Bakre & Jaiyeoba, 2009).

Okra is used to promotes a healthy of the pregnancy. An incredibly essential B vitamin for creating and maintaining new cells, foliate is a vital substance for optimum pregnancy. The vitamin aids in preventing birth defects just like spina bifida and enables the baby to develop completely. Vitamin C is additionally required for baby development. Okra is full of both foliate and vitamin C. The high quantity of foliate included in the okra is helpful for the fetus while pregnant. Foliate is a vital nutrient that increases the growth and development of the fetus' brain. The high quantity of folic acid within okra performs a huge role within the neural tube formation of the fetus through the fourth to the 12th week of pregnancy (Zaharuddin *et al.,* 2014).

Okra is used to improves heart health. The soluble fiber within okra helps you to reduce serum cholesterol and therefore decreases the chance of cardiovascular disease. Consuming okra is an efficient method to manage the body's cholesterol level. Okra is additionally loaded with pectin that can help in reducing high blood cholesterol simply by modifying the creation of bile within the intestines (Ngoc *et al.,* 2008). Okra is also used to improves good eyesight. The okra pods are fantastic options for Vitamin A and also beta carotene that are both important nourishment for sustaining an excellent eye-sight along with healthy skin. Additionally, these types of important nourishment also assist inhibits

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eye associated illnesses along with problems on the skin. Okra is better ingested when joined along with other healthy veggies. Consuming okra has truly numerous advantages, simply bear in mind to eat natural veggies as opposed to processed veggies (Messing *et al.,* 2014).

Okra is used to controls the body's cholesterol level. There are numerous significant illnesses related to high cholesterol level of the entire body. Managing the body's cholesterol level is nearly difficult because it's hard to avoid foods loaded with cholesterol content. One of the better health advantages of consuming okra is definitely the powerful management of the human body's high cholesterol level. This healthy vegetable is beneficial in slimming down and also decreasing cholesterol therefore keeps a healthy and also low cholesterol body. Okra have been taken advantage by diet advisors due to these qualities (Zaharuddin *et al.,* 2014).

Generally, okra is used to stabilize blood sugar by regulating the rate at which sugar is absorbed from the intestinal tract. It is a good vegetable for those feeling weak, exhausted, and suffering from depression and it is also used in ulcers, lung inflammation, sore throat as well as irritable bowel. Okra is good for asthma patients and it also normalizes blood sugar and cholesterol levels (Sengkhamparn *et al.,* 2009). Previous studies reported that okra polysaccharide possesses anticomplementary and hypoglycemic activity in normal mice (Tomoda *et al.,* 1989) Also, okra polysaccharide lowers cholesterol level in blood and may prevent cancer by its ability to bind bile acids (Lengsfeld *et al.,* 2004; Kahlon *et al.,* 2007). Additionally, Okra seed possess blood glucose normalization and lipid profiles lowering action in diabetic condition (Sabitha *et al.,* 2011).

VI. Conclusion

The information presented here shows the potential nutritional importance of Okra and its role in improved nutrition and health. It is an affordable source of protein, carbohydrates, minerals and vitamins, dietary fibre and health promoting fatty acids. Scientific studies provide some evidence to support the potential beneficial effects of Okra components in lowering the risk for various chronic diseases, although information pertaining to the role of edible plant parts of Okra in disease prevention and the mechanisms of action are limited to date. This is due to the complex nature of disease etiology and various factors impacting their occurrence. It is imperative the scientific community continues to unravel the mechanisms involved in disease prevention and determine how food bio-actives from such foods as Okra can influence human health. Further research, needs to be performed to provide compelling evidence for the direct health benefits of Okra consumption. Therefore, promoting the consumption of traditional vegetables such as Okra could provide cheap sources of macro and micronutrients and mineral elements that can improve the nutritional status of resource-poor subsistence farmers in the area in particular and in Ethiopia in general. Furthermore, this vegetable can also be used as an indispensable tool when it comes to reducing the prevalence of malnutrition, especially among resource-constrained urban households in addition to rural household. Consumption of Okra by both low-income and high-income groups can also used as a means of dietary diversification approach.

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3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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Content

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References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

INDEX

A

Abelmoschus · 44, 45, 52, 53, 54, 55, 56, 57, 58
Adadevoh · 29, 31, 33, 37
Antiadhesive · 50
Aspergillosis · 2, 17
Aspergillus · 1, 2, 3, 4, 7, 10, 11, 13, 14, 15, 16, 17, 18
Associated · 2, 13, 14, 15, 16, 19, 29, 43, 48, 50, 51

B

Biocontaminants · 14, 18
Biocontaminants, · 14
Bronchodilators · 5, 7, 13

C

Carotenoids · 49
Chaetoglobo · 9
Chaetomium · 1, 2, 7, 9, 13
Chartarum · 2, 3, 4, 7, 11, 13, 16, 17, 18, 19
Chlamydial · 39
Chromanoxy · 49
Cladosporium · 1, 2, 7, 11, 13, 15

D

Devastatingly · 29
Diacylglycerols · 45

E

Ebola · 29, 31, 33, 34, 35, 36, 37
Elidemir · 16, 18
Erythematous · 6
Esculentus · 44, 45, 50, 52, 53, 54, 55, 56, 57, 58

G

Garciduenas · 19, 20
Gastroprotective, · 49
Georggiett · 20

H

Hematoxylin · 4, 7
Hemolysins · 11, 13, 16
Hemosiderosis · 1, 2, 6, 13, 16, 18
Hydroxycinnamic · 44, 47
Hydroxydolaabella · 9

J

Jaakkola · 15
Johnsson · 17

M

Methoxysterigmatocystin · 9, 13

N

Ndjouenkeu · 48, 56

O

Occup · 16, 17
Omowaye · 52, 57
Onyebuchukwu · 33
Osnaya · 20
Owolarafe · 45, 54, 57

P

Paszkiewicz · 20
petechae · 6

R

Roquefortine · 1, 2, 9, 10

S

Samanthi Bandara. · 27
Shotonde · 45, 57

Simandi, · 53
Smoragiewicz · 17
Somkotra · 25, 26, 27
Stachybotrys · 1, 2, 3, 4, 7, 9, 11, 13, 16, 17, 18, 19
Sterigmatocystin · 1, 9, 10

T

Tharanathan · 48, 53
Triacylglycerols · 45
Trombino · 49, 58



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