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Commentary from the Vice-Chancellor, Kenyatta University

May I take this opportunity to congratulate members of the editorial board for producing the inaugural issue of the East and Central Africa Medical Journal. The articles are of high quality and will definitely make a mark on the international arena. They have been well researched and peer reviewed by reputable international professionals in the medical field and other health sciences.

The upcoming Kenyatta University Teaching, Research and Referral Hospital will not only look at new horizons in the area of medicine but will also endeavour to fill the medical care gaps that compel many individuals to seek medical services outside the country (Medical tourism). The institution will provide services in Organ Transplant, Geriatric Care (old age medical challenges), Gender Based Violence, Cancer Management and Hospice Care, to mention but only a few. Benefits of Telemedicine will be embraced in the hospital operations thus tapping expertise from persons of international repute.

Ultra modern equipment in the hospital will ensure the best results not only in patient care service delivery but also in medical research. Collaborative programmes with other international medical institutions particularly in the areas of medical research sciences and therapeutics will therefore be embraced.

Medical scientists in the region are encouraged to publish in the new journal and to strengthen their research activities in their institutions. The new hospital will provide new direction in scientific medical research in order to offer answers to some of the new challenges in its specialized units and the associated clinical services in the region. Such challenges can be resolved through ardent scientific medical research, advanced training in different areas of medical specialization and laboratory technology.

It is expected that enormous medical research programmes will be initiated and their impact felt in the region and outside. Implementation of such research finding will be an important step towards changing health care provision in Kenya and in the region. Local journals including E & Central Africa Medical Journal will benefit immensely from such scientific research activities.

The hospital will be the first Teaching, Research and Referral Hospital fully owned by a public institution/university in the region.

Professor Olive M. Mugenda,
Vice-Chancellor of Kenyatta University, Kenya
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Welcome to the inaugural edition of the *East and Central Africa Medical Journal* (E&CAMJ) which focuses on a wide field of medical research and other related health sciences. The journal accepts original scientific and review articles of medical importance and other health related publications from different regions in Africa and outside. The content in this issue includes articles on psychiatric care, cancer audit, epidemiology and control of infectious diseases, laboratory experimental studies on possible HIV inhibitors and reproductive health.

E&CAMJ is another one in a large field of many, some of which have been there for ages. Many others started but did not go beyond the first few issues. So why start this one, especially in this region of the world where medical research is not well developed? One may also argue that the number of medical scientists being trained in the existing medical schools is very small. A couple of years back the doctor-patient ratio stood at 1:33,000 in rural Kenya and 1:30,000 in urban areas. One may therefore argue that the physicians are overwhelmed by the sheer number of patients that they do not have time for research, but it it is worth noting that patient’s clinical condition and disease presentation offer appropriate materials to generate a research subject, depending on the acute eye of the doctor. Medical research is therefore part and parcel of medical practices. It is a sharp doctor who will recognize the “out of the ordinary” presentation of certain case. Such cases must be reported to the rest of the world. Tropical diseases may have their unique characteristics whose mass effects in the body may have different outcomes. One notable health occurrence in many developing countries, Kenya included is the upsurge of morbidity due to none communicable diseases especially cancers, diabetes and kidney disease across all social structures in the communities. Chronic tropical diseases, some of which are known to interfere with various tissue functions especially due to continuous inflammatory response, may have a hand in the development of such none communicable diseases [1]. Paucity of research data in such areas is noticeable and it is a big challenge to the upcoming medical doctors, medical scientist and the associated learning institution. Upcoming medical schools are therefore challenged to expose more medical doctors and medical scientists to the related research discipline in order to bring the uniqueness of tropical diseases to light.

A number of universities in the tropical countries are starting the course of medicine, especially in different parts of Africa while the existing ones are increasing seats for the course as is the case in Kenya. Increased competition for the survival of such institutions is healthy and inevitable. No medical school can survive without continuous research activities and publication of the findings. One medical college in India, which was denied her request to increase the seat for the course by the Medical Council of India because of poor medical research record and lack of publication by the teaching staff, can attest to this [2]. The medical boards overseeing the training programmes in medical schools in our region are also bound by such rules. They must ensure that the universities do engage in serious medical research.

The high cost of serious medical research cannot be ignored notwithstanding. In most cases such high cost of running medical research programmes is beyond the capacity of many developing countries. An invariable connect between academic institutions, local industries and external donors must therefore be established in order to achieve the desired goals. The upcoming Ultramodern Kenyatta University Teaching, Research and Referral Hospital, which is a collaborative undertaking between the government of Kenya and the government of China is such an example. High agenda in this collaboration is medical research and human resource development in the areas of health sciences. PRIME KENYA, which is involved in capacity building in health systems, enhancement of medical Education and medical research, has recognized the importance of supporting
the publication of the medical journal and training of the upcoming medical scientist on scientific paper writing. It is expected that much scientific data will be rolled out as a result of such combined efforts.

Medical research involve conducting research in public health, biochemistry, clinical research, microbiology and immunology, nutrition and nursing sciences, physiology, oncology, surgery and research on many other none communicable diseases. While medical specialists engage in clinical or bedside and operation room type of investigations, most of the research in the field is pursued by biomedical scientists, biologists, chemists, pharmacists and physicists in post graduate programmes [2].

The scope of medical research is therefore limitless especially in the regions of tropical diseases where some unique environmental, climatic and social factors may influence development and manifestation of certain diseases. For example, could there be an aetiological association between certain chronic parasitic infection and cancer? [3,4]. This may hold the answer to the increasing incidences of cancers in communities in many parts of Africa. One Village Chief in a Schistosoma haematobium endemic region could not be far from the truth when he confided to me that “rarely my people live beyond sixty years because of the effects of the parasitic infections”. That was a clear challenge from a semi-illiterate village chief to the medical scientist.

Herbal plants are the forerunners of conventional medicine and in many cases the flora is still an important source of medicine in many communities in tropical countries, especially when the former is too expensive. There are some intrigues of traditional herbal medicine that needs to be brought out in the light through publications. One of such examples is the ages old practice of neutralizing the effects of Bacillus anthracis before partaking of meat from a cow that has just died of anthrax infection. The community neutralizes the deadly effect of the organisms by consuming certain wild berries immediately before partaking of the meat... and life continues. What is in these berries that only the local communities know?

Nature has its intrigues intact and it is now for the scientist to unruffled this through organized biomedical sciences research. Such research data must be published in peer reviewed journals like the E&CAMJ. Coming up of the E&CAMJ is therefore timely and appropriate. The only challenge now is for the institutions of higher learning to increase medical research capacity.

Enjoy our inaugural issue and forward your next publication to the journal for the next issue in August.

Dr. Ng’ethe Muhoho
Editor In-chief
The East & Central African Medical Journal.

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Original Research

Grandmultiparity: Reason for index pregnancy, contraception and relationship to the Millennium Development Goals

Adeniran AS1,2 Fawole AA1,2 Fakeye OO1,2

Abstract

Objective: To evaluate the reasons for index pregnancy and contraceptive use among grandmultiparas and relate these to the Millennium Development Goals (MDG).

Design: A matched case control study.

Setting: The antenatal clinic of the Department of Obstetrics and Gynaecology of the University of Ilorin Teaching Hospital, Ilorin, Nigeria.

Subjects/participants: Subjects were grandmultiparas (para ≥5) who presented for antenatal care at the antenatal clinic of the hospital while controls were equal number of age, educational level and social status matched multipara (para 2-4) at the antenatal clinic from 1st January to 31st June, 2010 selected by purposive sampling.

Main outcome measures: Level of education, social status, awareness and use of contraceptives, reasons for index pregnancy and the relationship of these characteristics to the Millennium Development Goals. The data was analyzed using EPI-INFO 6 statistical package with p-value, odds ratio and confidence interval.

Results: There were 66 grandmultiparas during the study period; 30% had no formal education while 66.7% were of low social status with 30.3% in social class IV and 36.4% in class V. Contraceptive awareness and use were similar in grandmultiparas and controls; awareness was [90.9% vs. 93.9%, OR=0.65, CI=0.17-2.4, P 0.7422] while use was 6.4% vs. 40.9%, OR= 0.83, CI= 0.41-1.66, P=0.7207. In both groups, the commonest contraceptive method was Depo-provera [16.7% vs. 15.1%, OR=1.12, CI=0.44-2.85, P 0.8120] while barrier method was the least used [3.0% vs. 6.1%, OR=0.48, CI=0.09-2.74, P=0.6761]. The mother’s reasons for index pregnancy were desire for more children in 33.3%, previous perinatal death in 28.8% and desire for a specific gender in 19.7% of grandmultiparas.

Conclusions: Majority of grandmultiparas were poor, uneducated with desire for large families, poor contraceptive users and suffered previous poor perinatal outcome. This is an indicator of a huge gap to fill in attaining the Millennium Development Goal-5 to improve maternal health by reducing maternal mortality by three quarters by 2015.

Keywords: Grandmultiparity, Grandmultipara, Millennium Development Goals

Introduction

Grandmultiparas remains common in low resource settings in contrast to the situation in developed countries where they are uncommon. They have been shown to contribute significantly to maternal mortality with 35-37% of maternal deaths in Benin-city[1] and 38.4% in Ilorin[2] both in Nigeria occurring in grandmultiparas.

Thus, in line with the Millennium Development Goal (MDG)-5 which aim to improve maternal health with a target of reducing maternal mortality ratio by three quarters by 2015, it is imperative to address this group of women who contributes significantly to maternal death. In addition, grandmultiparas occupy a central role for evaluating how close we are to achieving the Millennium Development Goals (MDGs) as a whole as this greatly impacts on the family unit, society and national development.

Pregnancy in grandmultiparas is made worse especially in sub Saharan Africa by the prevailing high level of poverty with its attendant malnutrition in these women. In addition, repeated pregnancies with short inter pregnancy interval is also rampant such that many are not able to replace loss from previous pregnancies before the next conception. Sequel to the poverty, majority of them are unable to afford the cost of modern antenatal care services and subsequently have unsafe deliveries at home or other places where skilled birth attendants are absent with no one to manage intrapartum and postpartum complications resulting quite often in maternal morbidities and mortality.

The aim of this study was to determine the current state of grandmultiparas and use them as a case study to evaluate efforts targeted at achieving the MDGs.
Materials and Methods

Study setting: The Department of Obstetrics and Gynaecology of the University of Ilorin Teaching Hospital ([UITH]), Ilorin, Nigeria.

Study design: This was a prospective case control investigation where the participants were grandmultiparas (Para ≥5) and equal number of age, educational level and socioeconomic status matched multiparas (Para 2-4) managed at the antenatal clinic of the hospital from 1st January to 31st July 2010.

Cases: These were pregnant women who had carried five or more previous pregnancies to viability (Para ≥5); Viability was defined as pregnancy lasting ≥28 weeks gestation irrespective of the outcome. Controls were multiparas (Para 2-4) who had carried between two to four previous pregnancies to viability irrespective of the outcome. The participants were those who agreed to participate in the study after the purpose was explained to them. A total of one hundred and thirty two participants who included sixty six grandmultiparas (Para ≥ 5) and equal number of matched multiparas ( Para 2-4) were recruited for the study, after calculation of sample size [3, 4].

Procedure for data collection: All pregnant women were informed about the study at the antenatal clinic of the Obstetrics and Gynaecology Department, UITH, Ilorin. All consenting grandmultiparas who satisfied the inclusion criteria were recruited into the study after obtaining a written informed consent. Controls were age, education status and social status matched multiparas (Para 2-4) who consented to participate in the study.

Purposeful sampling was applied in which all consenting participants were recruited. Questionnaire, which was previously pretested by the investigators was administered to all the participants at the antenatal clinic by the investigators with the help of four trained assistant interviewers. Social classification for the participants was done as recommended by Olusanjo et al [5].

Data analysis: The results were analyzed using the EPI-INFO-6 statistical software and the results expressed in tables form for comparison and calculations of p value, odds ratio and confidence intervals. P value <0.05 was taken as the statistical significance.

Participants’ consent: The purpose of the investigation was explicitly explained to the participants before commencement of the study and those willing to participate agreed to sign the relevant consent forms after they were assured of the confidentiality and anonymity of their participation.

Ethical consideration: Ethical clearance was obtained from the ethical review committee of UITH, Ilorin before commencement of the study and which was conducted in accordance with institutional guidelines and the Helsinki declaration on the conduct of research in human subjects.

Results

There were a total of 66 grandmultiparas and 66 multiparous controls in the study; they were aged 25-48 years. From Table 1, 30.3% of grandmultiparas had no formal education, 27.3% had primary, 28.8% secondary and 13.6% tertiary education respectively. In addition, 66.7% of them were of low socio economic status with 30.3% and 36.4% belonging to social classes IV and V. By study design, the age and social classes were the same among grandmultiparas and controls.

Table 1: Educational status and social class of grandmultiparas

<table>
<thead>
<tr>
<th>Social class</th>
<th>Frequency</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>II</td>
<td>4</td>
<td>6.0</td>
</tr>
<tr>
<td>III</td>
<td>18</td>
<td>27.3</td>
</tr>
<tr>
<td>IV</td>
<td>20</td>
<td>30.3</td>
</tr>
<tr>
<td>V</td>
<td>24</td>
<td>36.4</td>
</tr>
</tbody>
</table>

Level of formal education

| None          | 20 | 30.3 |
| Primary       | 18 | 27.3 |
| Secondary     | 19 | 28.8 |
| Tertiary      | 9  | 13.6 |

Note: By study design, the educational status and social class were the same for grandmultiparas and multiparas.

Table 2 shows that there was a high contraceptive awareness among both the subjects and their controls.

However, grandmultiparas had a slightly lower level of awareness compared to controls (90.9% vs 93.9%, OR=0.65, CI=0.17-2.4, P=0.7422); though the difference was not statistically significant. Also, use of contraceptive among grandmultiparas was 36.4% and 40.9% among controls and this was not statistically significant (OR=0.83, CI=0.41-1.66, P=0.7207). The various contraceptive methods used were injectable hormonal contraceptive (Depo-provera), combined oral contraceptive pill, intrauterine contraceptive device (IUCD) and the barrier method. The commonest contraceptive method used among both the subjects and controls was the Depo-provera while the least used method was the barrier method. The methods used showed that the subjects had a slightly higher usage of the Depo-provera compared to the controls (16.7% vs 15.1%, OR=1.12, CI=0.44-2.85, P=0.8120). Grandmultiparas had a slightly lower usage of all the other methods than multiparas though all were not statistically significant.
Table 2: Contraception awareness, usage and methods used among subjects and controls

<table>
<thead>
<tr>
<th>Grand multiparas</th>
<th>Multiparas</th>
<th>OR</th>
<th>CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>60(90.9)</td>
<td>62(93.9)</td>
<td>0.65</td>
<td>0.17-2.4</td>
</tr>
<tr>
<td>No</td>
<td>6(9.1)</td>
<td>4(6.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>24(36.4)</td>
<td>27(40.9)</td>
<td>0.83</td>
<td>0.41-1.66</td>
</tr>
<tr>
<td>No</td>
<td>42(63.6)</td>
<td>39(59.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method used</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>42(63.6)</td>
<td>39(59.1)</td>
<td>1.21</td>
<td>0.60-2.44</td>
</tr>
<tr>
<td>Depo-provera</td>
<td>11(16.7)</td>
<td>10(15.1)</td>
<td>1.12</td>
<td>0.44-2.85</td>
</tr>
<tr>
<td>COCP</td>
<td>6(9.1)</td>
<td>7(10.6)</td>
<td>0.84</td>
<td>0.27-2.66</td>
</tr>
<tr>
<td>IUCD</td>
<td>5(7.6)</td>
<td>6(9.1)</td>
<td>0.82</td>
<td>0.24-2.83</td>
</tr>
<tr>
<td>Barrier</td>
<td>2(3.0)</td>
<td>4(6.1)</td>
<td>0.48</td>
<td>0.09-2.74</td>
</tr>
</tbody>
</table>

IUCD = Intrauterine contraceptive device.
COCP = Combined oral contraceptive pills

Table 3 shows a broader range of reasons for index pregnancy among grandmultiparas compared to the controls. The reasons among grand multiparas ranged from desire for more children (33.3%), previous perinatal death (28.8%), desire for a specific gender among the children (19.7%), non compliance with contraceptive (13.6%) and new consort (4.5%).

However, among the multiparas, the reasons for index pregnancy were desire for more children (81.8%) and previous perinatal death. There was significant difference between the grandmultiparas and controls whose index pregnancy was due to desire for more children (OR=0.11, CI=0.05-0.25, P 0.001). No multiparas got pregnant because of desire for a particular gender of a child; this was not unexpected since they have not completed their family size.

Table 3: Reason for index pregnancy among subjects and controls

<table>
<thead>
<tr>
<th>Reason given</th>
<th>Grand multiparas</th>
<th>Multiparas</th>
<th>OR</th>
<th>CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desire for more children</td>
<td>22(33.3)</td>
<td>54(81.8%)</td>
<td>0.11</td>
<td>0.05-0.25</td>
<td>0.00</td>
</tr>
<tr>
<td>Previous death of a child</td>
<td>19(28.8)</td>
<td>12(18.2)</td>
<td>1.82</td>
<td>0.80-4.14</td>
<td>0.15</td>
</tr>
<tr>
<td>Want specific gender</td>
<td>13(19.7)</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Non-compliance with contraception</td>
<td>9(13.6)</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>New consort</td>
<td>3(4.5)</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>

NA = Not applicable

Discussion

The principal findings of this study were that about one in every three grandmultiparas had no formal education, while about two in every three of them were of low social class. In addition, despite a wide level of awareness, only one in every three of them was using modern contraceptive methods with Depo-provera as the commonest method. Of all grandmultiparas, the reason for index pregnancy was culture related in half of them (33.3% desired more children while 19.7% were seeking a baby of a particular gender). The reasons given by about one quarter of the respondents were health service related (28.8% were due to previous perinatal death). In all, 95.5% of the reasons for index pregnancy among grandmultiparas were preventable.

The high level of illiteracy reported in grandmultiparas compared with findings from Benin-city, Ile Ife and Enugu[6,7] where 57.5%, 81.5% and 61.6% of grandmultiparas were illiterates. The high level of low social class reported in this study was similar to 80.74% in Lagos, 62% in Enugu and 51.2% in Benin-City all in Nigeria [1,4,7]. These findings were not unusual since low literacy level as well as low socioeconomic status have been associated with desire to have many children.

The present study showed a high contraceptive awareness in both grandmultiparas and controls but a low uptake in both groups. This was comparable to the report in Benin city, Nigeria where 65% awareness level and 27% usage were reported [8] among grandmultiparas in Benin city, Nigeria [8]. Yet, this was higher than 7.8% usage rate reported among grandmultiparas in Ile-Ife, Nigeria [6]. The difference may be because Ilorin is a state capital like Benin-city where supplies of contraceptives may be better and the people more receptive to contraception unlike in Ile-Ife which is not a state capital. Besides, urban dwellers are more receptive to contraceptives [9], thus a higher degree of patronage.
Previous studies in Nigeria showed high knowledge and awareness rate about contraception but they consistently showed a poor uptake rate of the services [8,10,11]. The reasons attributed to this include the desire for large families, poverty, high parity, myths, fear of side effects, husband disapproval and male child preference [8,12,13]. In this study, there was a similar trend in contraceptive patronage by the study population. The commonest method was injectables followed by combined oral contraceptive pills and intrauterine contraceptive device. This agrees with the findings that injectables are becoming commoner with increasing uptake due to the advantage that it can be used discreetly without the knowledge of the partner [14]. However, oral contraceptive pills was reported as the commonest method used by grandmultiparas in Benin City, Nigeria [8].

Contraceptive prevalence in Nigeria was 11-13% and is below the sub Saharan average of 17% [9]. Areas of low contraceptive prevalence rate have been associated with high maternal mortality ratios [15] and Nigeria has been quoted to have the second highest maternal mortality in the world [16]. Low contraceptive use results in high fertility rate, high number of children per woman, large family units, larger population and a shorter population doubling time for the nation.

The data indicated that the two commonest reasons for index pregnancy among grandmultiparas was desire to have more children (33.3%) and previous death of a child (28.8%). These were similar to the findings of Kuti et al [6] who recorded the commonest reasons as desire for more children (25.9%) and death of a previous child (24.1%) among grandmultiparas in Ile-Ife, Nigeria [6].

Grandmultiparity has been shown to contribute significantly to maternal mortality where 35-37% of maternal deaths were recorded in Benin City [1] and 38.4% in Ilorin [2] both in Nigeria. This study is in line with the Millennium Development Goal where the finding represents a good predictor for evaluation of efforts towards achieving the MDGs. The strength of the study was its design as a case control study which allowed comparison with multiparas as controls. The limitation was the relatively small sample size and the use of one study centre.

**Grandmultiparity and the Millennium Development Goals (MDGs):** The MDGs represent a worldwide collaborative effort to reduce poverty and hunger, tackle ill-health, gender inequity, lack of education, lack of access to clean water and environmental degradation [17].

**MDG 1: Eradication of extreme poverty and hunger**

The vicious cycle of poverty, hunger and diseases have long been known; the poor are more exposed to personal and environmental factors that predispose to diseases and they are less likely to access health care [18]. The report of 66.7% of grandmultiparas being of low social classes suggests that we still have a long way to go in eradicating poverty and hunger.

**MDG 2: Achieve universal basic education**

Literacy increases health seeking behaviours; the 30.3% no formal education status among grandmultiparas in this study is far from the desired universal basic education by the year 2015 which is just around the corner.

**MDG 3: Promote gender equality and empower women**

In many developing countries, gender inequality is still demonstrated in form of preferences for specific gender by parents among the off springs. In many cultures, the care and investment in education still depend on the gender of the child with the balance in favour of male children. About a third of grandmultiparas in this study attributed the reason for index pregnancy to this wrong cultural norm. It has been reported that women empowerment and the ability to have a say in fertility choices has an association with the use of family planning methods while a low income level and partner’s approval are linked with low contraception uptake [19].

**MDG 4: Reduce child mortality**

High infant mortality rates still abound in many developing countries including Nigeria. This was evident in this study in which 28.3% of grandmultiparas attributed index pregnancy to previous perinatal deaths. This showed a reduction in the birthing interval, possible absence of skilled birth attendants with skill in neonatal resuscitation at all deliveries and addressing of strategies to improve child survival will be desired in this populace.

**MDG 5: Improve maternal health**

Poverty has been associated with poor health seeking behavior and reduced access to reproductive services. These poor grandmultiparas are unlikely to deliver with skilled birth attendants thereby hindering the actualization of Target 6 which is aimed at the presence of skilled birth attendants at all deliveries. The significant contribution of grandmultiparas to maternal mortalities in Benin City [1] and Ilorin [2] as cited above calls for more pragmatic efforts at reducing the incidence of grandmultiparity to lower these deaths. Family planning is important for improved maternal health; it enables the mothers to plan when and how soon to become pregnant thereby eliminating risky pregnancies. However with grandmultiparity the risk increases exponentially.

**MDG 6: Combat HIV/AIDS, malaria and other diseases**

Target 6 seeks to increase contraceptive use among currently married women aged 15-49 years as well as promote condom use. The low contraceptive uptake among participants in this study as well as the low condom use in particular does not suggest an improvement from the situation since the introduction of the MDGs.

**MDG 7: Ensure environmental sustainability**

Target 9 seeks to integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental reserves. Uneducated women of low social class as demonstrated in this study are likely to use firewood in cooking which will lead to depletion of forest areas, reduction in proportion of protected land surface area and increase in carbon dioxide emission contributing to further depletion of the ozone layer. In addition, increased waste production, conversion of land for recreation into residential and other activities as well as use of funds for environmental protection on meeting the challenges of overpopulation will worsen environmental sanitation.
MDG 8: Develop global partnership for development
Target 8 seeks to make available the benefit of new technologies, the indicators include number of internet users, internet users per 100 population, personal computers and personal computers per 100 population. There is no doubt that a 30.3% illiteracy level among grandmultiparas does not favour this target. Thus, the benefit of these avenues in education on reduction of harmful cultural practices, improvement of health seeking behavior and health education are jeopardized.

Conclusion
Culture related factors of desire for large families and specific gender among off springs were responsible for 53% of pregnancy in grandmultiparas in this study. Despite a high contraceptive awareness among grandmultiparas, usage remains low. Perinatal death remains reasonably high with 28.8% desiring index pregnancy to replace a previous perinatal loss. These reports show that there is still a lot to be done towards actualization of the MDGs. The study demonstrated the continuing presence of grandmultiparity and the implication on the MDGs; it presents a template for a multicentre survey to allow wider generalization of the results.

Recommendations
From the results of this study, cultural reorientation occupies a central role as a major strategy in preventing grandmultiparity and its attendant pregnancy complications. It shows that there is the need to intensify community-based interventions to dissuade our women from grandmultiparity. The awareness but low patronage of contraceptives further corroborates this need.

In addition, there is need to improve child survival strategies to increase infant survival since about a quarter of pregnancies in this study were due to previous perinatal loss.

Finally, all stake holders must rededicate resources towards the actualization and sustenance of the MDGs.

Sponsorship/ conflict of interest
The study was self sponsored by the researchers and there was no conflict of interest in the conduct of the study.

References
Abstract

Background: Postpartum sexual problems are common in many populations but not much has been documented in the African women.

Objectives: To screen for postpartum sexual dysfunction through a simple questionnaire.

Design: A prospective cross-sectional survey.

Methods: The study involved 1,200 consecutive and consenting postpartum women at the Abia State University Teaching Hospital postnatal clinic, Aba, Southeastern Nigeria over the period 1st June – 1st September, 2012. Using a simple questionnaire as described by Plouffe, the subjects were screened for postpartum sexual dysfunction during immunization visits at six, ten, fourteen and thirty-six weeks postpartum. Consenting clients self-completed the questionnaire or were assisted to do so by research assistants.

Results: By 14 weeks postpartum, 49.3% of the subjects had resumed sexual activity. Being primiparous was more likely to be associated with resumption of sexual activity by 14 weeks (p < 0.05). Reported postpartum sexual dysfunction included painful intercourse (21%), difficulty with lubrication during sex (26.2%), pain at penetration during sex (20.4%), deep pain during sex (20%) and difficulties achieving orgasm (20%). Only 40.5% of the subjects were counseled about postpartum sexual activity during the antepartum period.

Conclusion: Postpartum sexual dysfunction are common in this population as in other racial groups. Our findings affirm the recommendation for counseling and preparation of antenatal and postnatal clinic attendees about postpartum sexual activity and function.

Keywords: Postpartum, Sexual Dysfunction, African Women.

Introduction

Postpartum sexual function and health are relatively neglected and have been the subject of little research especially in African women. Although models of sexual function vary, sexual dysfunction is defined in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition psychiatric manual as disorders of desire, arousal, orgasm or pain[1]. Sexual dysfunction is a disorder that relies on self-report for both diagnosis and treatment[2]. Valid and reliable measures that screen for sexual dysfunction may aid in both the diagnosis and treatment of postpartum sexual dysfunction and patients may feel more comfortable reporting problems to healthcare providers through a questionnaire when compared with direct interviews[3].

The knowledge of the nature of postpartum sexual dysfunction will assist in developing a strategy to inform and educate women and healthcare providers regarding postnatal sexual function and activity. Hence, the need for this study.

Materials and Methods

This was a prospective cross-sectional survey involving 1,200 consecutive and consenting postpartum women at the Abia State University Teaching Hospital postnatal clinic, Aba, Southeastern Nigeria over the period 1st June – 1st September, 2012. Plouffe describes a simple screening questionnaire of three questions that asks whether a patient is sexually active, if active, are there any problems, and whether or not the individual experiences sexual pain[4]. Using a simple questionnaire as described by Plouffe, the subjects were screened for postpartum sexual dysfunction during immunization visits at six, ten, fourteen and thirty-six weeks postpartum. Consenting clients self-completed the questionnaire or were assisted to do so by research assistants.

During data analysis, simple proportions were used in descriptive analyses to compare the prevalence of several factors describing postpartum sexual functioning. Chi-square and Fisher exact tests were used to compare demographic variables. Statistical analysis were performed using Epi-info version 6 statistical package. P<0.05 was considered significant. Ethical approval was obtained from the research and ethical committee of Abia State University Teaching Hospital, Aba.
Results

By 14 weeks postpartum, 49.3% of the subjects had resumed sexual activity. Table 1 shows the demographics of the participants with sexual activity by 14 weeks postpartum. Being primiparous and aged 30 years or older were more likely to be associated with resumption of sexual activity by 14 weeks (p < 0.05).

Table 1: Relationship between demographics of the participants and sexual activity by 14 weeks post partum

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sexually active (n= 450) (%)</th>
<th>Sexually inactive (n= 462)(%)</th>
<th>OR</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;19</td>
<td>14 (3)</td>
<td>19 (4.2)</td>
<td>0.76</td>
<td>0.35-1.60</td>
<td>0.54</td>
</tr>
<tr>
<td>20-29</td>
<td>255 (57)</td>
<td>248 (53.6)</td>
<td>1.06</td>
<td>0.84-1.32</td>
<td>0.66</td>
</tr>
<tr>
<td>≥ 30</td>
<td>179 (40)</td>
<td>195 (42.2)</td>
<td>0.09</td>
<td>0.05-0.15</td>
<td>0.00</td>
</tr>
<tr>
<td>Parity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primipara</td>
<td>21 (48.2)</td>
<td>230 (49.7)</td>
<td>0.09</td>
<td>0.06-0.15</td>
<td>0.00</td>
</tr>
<tr>
<td>Multipara</td>
<td>233 (51.8)</td>
<td>232 (50.3)</td>
<td>1.03</td>
<td>0.82-1.30</td>
<td>0.83</td>
</tr>
<tr>
<td>Method of delivery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaginal delivery</td>
<td>20 (4.0)</td>
<td>15 (3.2)</td>
<td>1.37</td>
<td>0.66-2.85</td>
<td>0.46</td>
</tr>
<tr>
<td>No episiotomy</td>
<td>24 (54.0)</td>
<td>24 (53.8)</td>
<td>1.03</td>
<td>0.55-1.90</td>
<td>0.95</td>
</tr>
<tr>
<td>Episiotomy or tears</td>
<td>104 (23.0)</td>
<td>110 (24.0)</td>
<td>0.97</td>
<td>0.71-1.32</td>
<td>0.90</td>
</tr>
<tr>
<td>Caeserean delivery</td>
<td>85 (19.0)</td>
<td>88 (19.0)</td>
<td>0.99</td>
<td>0.71-1.39</td>
<td>0.97</td>
</tr>
</tbody>
</table>

Table 2 shows the frequency of responses to selected simple screening questions identifying sexual dysfunction in sexually active participants 14 weeks postpartum. Reported postpartum sexual problems included painful intercourse (21%), difficulty with lubrication during sex (26.2%), pain at penetration during sex (20.4%), deep pain during sex (20%) and difficulties achieving orgasm (20%). Only 40.5% of the subjects were counseled about postpartum sexual activity during the antepartum period.

Table 2: Frequency of responses to selected simple screening questions identifying sexual dysfunction in sexually active participants 14 weeks postpartum (n=450)

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having problems with sex life since delivery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>84</td>
<td>19</td>
</tr>
<tr>
<td>No</td>
<td>366</td>
<td>81.3</td>
</tr>
<tr>
<td>Having pain with intercourse since delivery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>93</td>
<td>21</td>
</tr>
<tr>
<td>No</td>
<td>347</td>
<td>77.1</td>
</tr>
<tr>
<td>Having difficulty with lubrication during sex since delivery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>118</td>
<td>26.2</td>
</tr>
<tr>
<td>No</td>
<td>332</td>
<td>74</td>
</tr>
<tr>
<td>Experienced pain at penetration during sex since delivery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>92</td>
<td>20.4</td>
</tr>
<tr>
<td>No</td>
<td>358</td>
<td>80.4</td>
</tr>
<tr>
<td>Experienced deep dyspareunia during sex since delivery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>88</td>
<td>20</td>
</tr>
<tr>
<td>No</td>
<td>362</td>
<td>80.4</td>
</tr>
<tr>
<td>Experienced difficulties achieving orgasm since delivery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>90</td>
<td>20</td>
</tr>
<tr>
<td>No</td>
<td>360</td>
<td>80</td>
</tr>
<tr>
<td>Rating of degree of satisfaction with sexual activity since delivery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very good</td>
<td>91</td>
<td>20.2</td>
</tr>
<tr>
<td>Good</td>
<td>265</td>
<td>59</td>
</tr>
<tr>
<td>Poor</td>
<td>94</td>
<td>21</td>
</tr>
</tbody>
</table>
Discussion

The findings of our study show that by 14 weeks postpartum, 49.3% of the postpartum women had resumed sexual activity and that postpartum sexual dysfunction are common. Being primiparous and aged 30 years or older were more likely to be associated with resumption of sexual activity by 14 weeks. Studies elsewhere indicate that resumption of sexual activity postpartum is rapid as approximately half (52%) of women resume sexual activity by 5-6 weeks postpartum[2]. By three months postpartum, 90% of women had resumed sexual activity[5,6]. This figure of 90% is much higher than the figure of about 49.3% obtained in our study. This difference may be explained by the practice by some couples in our environment to defer sexual contacts with their spouses until the new baby was able to walk. Some communities also prohibit sexual contacts during the breastfeeding period. Some women may also defer resumption of sexual activity as a result of concerns about becoming pregnant again. Reported postpartum sexual problems included painful intercourse (21%), difficulty with lubrication during sex (26.2%), pain at penetration during sex (20.4%), deep pain during sex (20%) and difficulties achieving orgasm (20%). Postpartum sexual dysfunction (including dyspareunia) is identified in 41-83% of women at 2-3 months postpartum[7,8]. Dyspareunia is extremely common in the first 3-6 months postpartum; Barrett et al [7] reported that 55% of women experienced painful penetration and 45% experienced painful intercourse at 2 months postpartum. Although a common concern, both physicians and women may defer discussing sexual concerns during pregnancy and postpartum as a result of patient discomfort in bringing up the issue or the healthcare provider’s lack of training in obtaining an appropriate sexual history[9].

Strengths of our study include the fairly large sample size. Limitations include possible selection bias as the participants were volunteers and not selected randomly.

In conclusion, the study showed that postpartum sexual problems are common in this population as in other racial groups. Our findings affirm the recommendation for counseling and preparation of antenatal and postnatal clinic attendees about postpartum sexual activity and function.

Acknowledgements

To Ifeoma Onungwa, Nkiru Angela Osuala, Dr. Adanma Ahuche and Ezinne Ahuche for data collection. We declare that we have no conflict of interest.

References

Patterns of *Schistosoma mansoni* and soil-transmitted helminth infections among school children and the related transmission risk factors in the rice irrigation area and the adjoining regions in Mwea, Central Kenya

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4Eastern & Southern Africa Centre of International Parasite Control, Kenya Medical Research Institute.  
5Kenyatta University, Nairobi, Kenya  
6Mount Kenya University, Kenya

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Abstract

Background: *Schistosoma mansoni* and soil transmitted helminths (STH) are co-endemic in Mwea rice growing wet land regions and in the surrounding non rice growing areas in central Kenya. The burden of both diseases and their impact in the country’s economy cannot be overemphasized. Kenya Vision 2030 aspires to turn the country into a medium income country, hence the urgent need to control these neglected tropical diseases.

Objective: To establish the parasitological baseline data on prevalence and intensity of the infection in school children in the rice-growing regions and the neighbouring non-rice growing areas in order to initiate a school-based parasite control programme in all schools in Mwea Division, Central Kenya.

Methods: A total of 3,809 stool specimens was collected from Grade 3 school children (aged 9-12 years) in all 86 primary schools in the Division and examined for *S. mansoni* and soil transmitted helminths (STH) ova using modified Kato-Katz -cellulose film thick smear technique. Prevalence and intensity of infection were determined and compared between rice irrigation regions and non-irrigation areas, public and private schools, and schools using surface and non-surface water sources.

Results: Overall prevalence for *S. mansoni* was 36% (37.2% for boys and 34.8% for girls) and 15.1% for STH infections (Hookworm *Ascaris lumbricoides*, *Trichuris trichiura*). Hookworm was the predominant STH, 14% for boys and 10% for girls. Overall geometric mean intensity for *S. mansoni* was 4.8 eggs and 0.7 for hookworm per gram of faeces (EPG). Prevalence for *S. mansoni* was significantly higher in the irrigation area (43%) than in non-irrigation area (22%, p < 0.001), higher in the public schools (38%) than in the private schools (18%, p < 0.001) and higher in schools using surface water (42%) than with other water sources (22%, p < 0.001). On the other hand, prevalence of hookworm was significantly higher in non-irrigation area (16%) than in the irrigation area (10%, p < 0.001) and higher for boys (14%) than girls (10%, p < 0.001). Intensity of infection followed a similar trend in both infections. Logistic regression analyses revealed that all studied risk factors independently contributed to infections of *S. mansoni* and hookworm. *Ascaris lumbricoides, Trichuris trichiura* were found only in small numbers of children.

Conclusion: *Schistosoma mansoni* and soil transmitted helminths infections are highly distributed in Mwea rice irrigation region and the adjacent regions. Heterogeneous nature of the risk factors of transmission call for well-planned integrated interventions.

Key words: *Schistosoma mansoni*, soil transmitted helminths, hookworm, rice irrigation areas, school children, risk factors, prevalence of infection

Introduction

Schistosome infection and soil-transmitted helminths (STH) are major causes of morbidity in developing countries and big burdens to the national public health care system [1,2]. Both infections are the result of poverty, poor sanitation and they generally co-exist in endemic state in many countries in Africa [3-6]. Irrigational programmes for food security may contribute to increasing incidence of schistosome infections because of the accompanying increase in the population of vector snail for the parasite [7]. Similarly, poor sanitation leads to increased levels of contamination of the environment especially the soil [8] thus increased risks of STH infections. The focus for this study is Mwea Rice Irrigation Settlement Scheme in Central Kenya where about 90% of rice in the country is produced. *Schistosoma mansoni* and STH are co-endemic. Earlier studies in this region attributed transmission of STH infection and schistosomiasis to lack of household latrines or misuse of the existing ones; lack of latrines in the paddies and the subsequent indiscriminate excreta disposal along the water canals.
These factors contribute to sustenance of schistosome infection in the vector snail populations in the irrigation canals [9-11].

The study provides parasitological baseline data on school children in all 86 schools in Mwea Division for the purpose of planning of interventions for *Schistosoma mansoni* and STH infections in Mwea irrigation scheme and its neighbouring rice non-growing communities. The study will also examine the environmental risk factors and other characteristics which could determine the appropriate type of intervention measures. According to WHO, deworming of school children is an important control method of transmission of the infections in endemic communities [12] but integrated interventions would have long term effects in the community.

Materials and Methods

**Site of study:** The study was conducted in Mwea Division Kirinyaga District in Central Kenya about 100km north east of Nairobi, the capital city. The population in Mwea Division was 125,962 people in 31,540 households within 513 square kilometres according to the 1999 census [13]. Mwea rice farming region is mainly plain land where the irrigation scheme covers 12,140 hectares out of which about 6000 hectares of low land is used for rice growing (irrigation area) on black cotton clay soil. The rest of the land (non-irrigation area) is on raised grounds mainly on loam red soil and is used for farmers’ villages, rain fed food crop especially horticultural produce, and for public utilities [14,15]. About 60,000 people were living within the irrigation areas mainly in villages according to the last national registration census [13]. Irrigation water is directed to the paddy fields through a network of canals from Thiba and Nyamindi Rivers. Households in the irrigation area are in village clusters. There is no piped water supply in the villages and water canals around the villages and the paddies serve the domestic needs. Most of the homesteads have household pit latrines majority of which are unsanitary and unhygienic (I.M Personal communication). Underground water level is high in many places a condition which results in overflowing of many pit latrines during rainy season [11]. Non-irrigation areas cover large regions surrounding the irrigated land. Households in these areas are spread out in individual smallholder farms. Horticultural agriculture is conducted around the year [14,15] resulting in continuous interaction with the contaminated soil.

**Demographic survey:** All the schools in the Division were registered. There were 58 public or government-owned schools and 28 privately owned ones. Forty-one schools were registered within the irrigation area while 45 schools were in the non-irrigation area. All the children in all the schools (86) in the Division were registered (36,796 children).

**Stool examination:** According to WHO, children age group 9-12 years are a high risk group in the transmission of infections in question and they make a good population sample for determination of prevalence and intensity of infection in school [12] and the community in general. This age group is found in Standard 3(Grade 3) in the Kenyan school system. There were 4219 children registered in Grade 3 in all 86 schools in the Division.

To collect the specimen, Grade 3 children were registered the day before stool specimen collection in each school. Each child was given a specimen cup bearing his/her name and code number and instructed, through the teacher to bring in the first morning stool (24 hour stool specimen). The stool specimen were collected the first thing in the morning before the beginning of classes by our laboratory technicians and transported immediately to the Division of Vector-borne Diseases (DVBD) laboratory, Ministry of Health laboratory in Kimbimbi Hospital for processing and microscope examination. The average number of school children was 59 per school (range 4 to 108). The survey period took three months to cover all the schools.

**Prevalence and intensity of infection:** Kato-Katz -cellulose film thick smear technique, using 41.7mg template were made by trained technicians and the prevalence and intensity of infection made. Prevalence of *S. mansoni* and STH was determined by detection of respective ova in the stool sample specimen under a microscope. Intensity of infection was determined by multiplying the egg counts by 24 to calculate the number of parasite eggs per gram of stool (EPG) [12]. Hookworm examination was done within 30 to 60 minutes after specimen preparation in order to avoid clearing up of the hookworm ova in the specimen. All specimens were examined by the same well trained laboratory technicians.

**Data analysis:** Due to the wide range in the number of children examined per school (lowest recorded in private schools while congestion was seen in public schools, individual-level analyses were made in this study rather than school-level analyses. Laboratory information was entered in the raw data forms at the laboratory before entering it in the excel sheets. Data analysis was done using SPSS 10 for Windows package to determine the prevalence and intensity of the infections. Mean intensity was expressed as geometric mean of eggs per gram of faeces (EPG). Prevalence and intensity were compared between public and private schools, between schools inside and outside of the irrigation area and water source in schools (surface water or piped/well water). Chi-square was used to determine the differences in prevalence and Student-t test was used for the difference in the intensity of infection. Binary logistic regression analysis was made to assess risk factors related directly to individual *S. mansoni* and hookworm infections.

**Results**

Of the 4219 Grade 3 children registered only, 3809 (93.5%) of them returned cups with specimen (1937 boys and 1872 girls) from all the 86 schools in the Division. Data on distribution of the infection indicated that 87% of the schools had children infected with *S. mansoni*, and 86% infected with STH (Figure 1).
Figure 1: Distribution of parasites among schools

Parasitological examination: Eggs of *S. mansoni*, hookworm, *Ascaris lumbricoides*, and *Trichuris trichiura* were the major intestinal parasites found in stool specimens (Table 1). Prevalence and intensity of *S. mansoni* were higher within the irrigation area while STH infections were higher in non-irrigation areas.

**Table 1**: Overall prevalence of intensity of *Schistosoma mansoni* and soil transmitted helminths among 3809 children in Mwea Division, Central Kenya

<table>
<thead>
<tr>
<th>Parasite</th>
<th>Prevalence (%)</th>
<th>Intensity <em>(EPG)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>S. mansoni</em></td>
<td>36.1 (1371/3809)</td>
<td>4.83</td>
</tr>
<tr>
<td>Hookworm</td>
<td>12.1 (461/3809)</td>
<td>0.74</td>
</tr>
<tr>
<td><em>A. lumbricoides</em></td>
<td>2.2 (84/3809)</td>
<td>0.13</td>
</tr>
<tr>
<td><em>T. trichiura</em></td>
<td>1.4 (54/3809)</td>
<td>0.06</td>
</tr>
<tr>
<td>Overall <em>STH</em></td>
<td>15.0 (579/3809)</td>
<td>(-)</td>
</tr>
</tbody>
</table>

*EPG= Eggs per gram
*STH = Soil Transmitted Helminths

Table 2 compares prevalence and intensity of infection based on gender. Intensity of infection (EPG) followed similar pattern as prevalence in both parasites. Significantly higher geometric mean egg count was recorded in hookworm infections in boys than in girls.

**Table 2**: Prevalence and intensity (EPG) of *Schistosoma mansoni* and soil transmitted helminths infection among school children by gender in Mwea Division, Central Kenya

<table>
<thead>
<tr>
<th>Parasite</th>
<th>Male (n=1937)</th>
<th>Female (n=1937)</th>
<th>Total (n=3908)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. lumbricoides</td>
<td>2.3 (%)</td>
<td>2.1 (%)</td>
<td>2.2 (%)</td>
<td>0.777</td>
</tr>
<tr>
<td>T. trichiura</td>
<td>1.4 (%)</td>
<td>1.4 (%)</td>
<td>1.4 (%)</td>
<td>0.899</td>
</tr>
<tr>
<td>Hookworm</td>
<td>14.4 (%)</td>
<td>10.0 (%)</td>
<td>12.2 (%)</td>
<td>0.000</td>
</tr>
<tr>
<td>S. mansoni</td>
<td>37.4 (%)</td>
<td>34.8 (%)</td>
<td>36.1 (%)</td>
<td>0.124</td>
</tr>
</tbody>
</table>

Geometric mean (EPG)

<table>
<thead>
<tr>
<th></th>
<th>Al</th>
<th>Tt</th>
<th>Hw</th>
<th>Sm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.14</td>
<td>0.06</td>
<td>0.92</td>
<td>5.18</td>
</tr>
<tr>
<td>Tt</td>
<td>0.12</td>
<td>0.06</td>
<td>0.58</td>
<td>4.5</td>
</tr>
<tr>
<td>Hw</td>
<td>0.75</td>
<td>0.6</td>
<td>0.75</td>
<td>5.2</td>
</tr>
<tr>
<td>Sm</td>
<td>0.45</td>
<td>0.6</td>
<td>0.2</td>
<td>0.143</td>
</tr>
</tbody>
</table>

Of the total number of children examined, 46.5% (891 males, 880 females) attended public schools which used surface water in the irrigation areas and 48.8% of them were infected with *S. mansoni* and 11.7% with hookworm. The number of infected boys using surface water in these schools did not differ much from the number of infected females (49.8% vs. 47.7%, *S. mansoni* and 12.7% vs 10.8% for hookworm, respectively. Prevalence as high as 22.5% in hookworm infection was recorded among 414 boys attending public schools with surface water source in non-irrigation area, while it was as low as 0.9% among 113 girls attending private school within the irrigation area and using non-surface water source (Table 3).
Table 3: Prevalence of *S. mansoni* and hookworm among school children by water source, gender and school type in Mwea Division, Central Kenya

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>* (n)</th>
<th>S. mansoni Prevalence %</th>
<th>Hookworm Prevalence %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public schools - surface water - irrigation</td>
<td>891</td>
<td>49.8</td>
<td>12.7</td>
</tr>
<tr>
<td>Public schools - no-surface water - irrigation</td>
<td>220</td>
<td>43.2</td>
<td>10.5</td>
</tr>
<tr>
<td>Public schools - surface water - non-irrigation</td>
<td>414</td>
<td>29.7</td>
<td>22.5</td>
</tr>
<tr>
<td>Public schools - no surface water - non-irrigation</td>
<td>204</td>
<td>7.4</td>
<td>16.2</td>
</tr>
<tr>
<td>Private schools - surface water - irrigation</td>
<td>49</td>
<td>30.6</td>
<td>8.2</td>
</tr>
<tr>
<td>Private schools - no-surface water - irrigation</td>
<td>115</td>
<td>19.1</td>
<td>3.5</td>
</tr>
<tr>
<td>Private schools - surface water - non-irrigation</td>
<td>13</td>
<td>46.2</td>
<td>7.7</td>
</tr>
<tr>
<td>Private schools - no-surface water - non-irrigation</td>
<td>31</td>
<td>0.0</td>
<td>6.5</td>
</tr>
<tr>
<td>Total</td>
<td>1937</td>
<td>37.2</td>
<td>14.1</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public schools - surface water in irrigation</td>
<td>880</td>
<td>47.7</td>
<td>10.8</td>
</tr>
<tr>
<td>Public schools - non-surface water in irrigation</td>
<td>218</td>
<td>34.4</td>
<td>9.6</td>
</tr>
<tr>
<td>Public schools - surface water in non-irrigation</td>
<td>377</td>
<td>28.9</td>
<td>13.8</td>
</tr>
<tr>
<td>Public schools - non surface water in non-irrigation</td>
<td>189</td>
<td>8.5</td>
<td>9.5</td>
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<tr>
<td>Private schools - surface water in irrigation</td>
<td>62</td>
<td>17.7</td>
<td>0.0</td>
</tr>
<tr>
<td>Private schools - non-surface water in irrigation</td>
<td>113</td>
<td>15.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Private schools - surface water in non-irrigation</td>
<td>10</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Private schools - non-surface water in non-irrigation</td>
<td>23</td>
<td>4.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>1872</td>
<td>34.8</td>
<td>10.0</td>
</tr>
</tbody>
</table>

* *(n)* = The number of school children in each variable

Compared by other risk factors (Table 4) the prevalence of *S. mansoni* infection was significantly higher in children within the irrigation area (43.2%) than those residing in rice non-irrigation areas (21.5%, p<0.001), in public schools (38.2%) than in the private schools (17.8%, p<0.001) and in schools using surface water (41.9%) than in those using other water sources (21.7%, p<0.01). No significant difference was noted by gender in *schistosoma* infection. Prevalence for hookworm was significantly higher in children from non-irrigation area (15.9%) than in the rice growing area (10.2%), p<0.001. Intensity rates followed similar pattern of infection in both parasites.

Table 4: Prevalence of *S. mansoni* and hookworm by risk factors among school children in Mwea Division, Central Kenya

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>S. mansoni infection</th>
<th>Hookworm infection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prevalence (%)</td>
<td>Odds Ratio (95%CI*)</td>
</tr>
<tr>
<td>School location (area)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrigation (n=41)</td>
<td>43.2</td>
<td>0.36 (0.31-0.42)*</td>
</tr>
<tr>
<td>Non-irrigation (n=45)</td>
<td>21.5</td>
<td>15.9</td>
</tr>
<tr>
<td>School type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public (n=58)</td>
<td>38.2</td>
<td>0.35 (0.27-0.45)*</td>
</tr>
<tr>
<td>Private (n=28)</td>
<td>17.8</td>
<td>3.1</td>
</tr>
<tr>
<td>School water source</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface (n=60)</td>
<td>41.9</td>
<td>0.39 (0.33-0.45)*</td>
</tr>
<tr>
<td>Non-surface (n=26)</td>
<td>21.7</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys (1937)</td>
<td>37.2</td>
<td>0.90 (0.79-1.03)*</td>
</tr>
<tr>
<td>Girls (1972)</td>
<td>34.8</td>
<td></td>
</tr>
</tbody>
</table>

Significant by chi-square test, P< 0.001, NS = not significant, CI* = Confidence interval
Table 5: Results of logistic regression analysis of S. mansoni infection among school children in Mwea Division, Central Kenya

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>S.E.</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>95%CI</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>School type</td>
<td>-1.052</td>
<td>0.142</td>
<td>0.000</td>
<td>0.349</td>
<td>0.264-0.462</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water source</td>
<td>-0.706</td>
<td>0.088</td>
<td>0.000</td>
<td>0.493</td>
<td>0.415-0.586</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td>-0.67</td>
<td>0.044</td>
<td>0.000</td>
<td>0.512</td>
<td>0.470-0.557</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-0.145</td>
<td>0.072</td>
<td>0.043</td>
<td>0.865</td>
<td>0.752-0.996</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>2.913</td>
<td>0.222</td>
<td>0.000</td>
<td>18.416</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Risks of contracting hookworm infection (Table 6) was significantly higher in children attending schools in non-irrigation area (odds ratio of infection of no-irrigation to irrigation, 1.591, 95% CI; 1.413-1.791).

Table 6: Results of logistic regression analysis of hookworm infection among school children in Mwea Division, Central Kenya

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>S.E.</th>
<th>Sig.</th>
<th>Exp(B)</th>
<th>95%CI</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>School type</td>
<td>-1.243</td>
<td>0.293</td>
<td>0</td>
<td>0.289</td>
<td>0.163-0.512</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water source</td>
<td>-0.367</td>
<td>0.123</td>
<td>0.003</td>
<td>0.693</td>
<td>0.544-0.882</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td>0.464</td>
<td>0.06</td>
<td>0</td>
<td>1.591</td>
<td>1.413-1.791</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-0.375</td>
<td>0.102</td>
<td>0</td>
<td>0.687</td>
<td>0.562-0.840</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-0.604</td>
<td>0.376</td>
<td>0.108</td>
<td>0.546</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The load of parasite eggs available to contaminate the environment is important for transmission of parasitic infections and this is generally attributed to a section of the population having heavy infection [17]. In the current study, significantly higher mean egg count and risks of infection were observed in children within the irrigation for S. mansoni infection (odds ratio of infection of non-irrigation to irrigation, 0.512, 95% CI; 0.470-0.557).

Discussion

The findings in this study give the information necessary for planning of intervention measures for both schistosomiasis and helminthiasis. Children in public schools within the irrigation area and using surface water source (46%) were exposed to significantly higher risks of contracting schistosome infection (49%) than others. Water canals were the main source of water around the villages and schools. The canals were previously reported to be infested with Biomphalaria pfeifferi, the vectors for S. mansoni [9,19].

Abundance of water especially during heavy rains [11] was associated with overflowing of pit latrines in areas with high levels of underground water thus increased risks of infection. Although individual-level analyses of infection were made in this study rather than school-level analyses, large difference in the distribution of infections per school was noted (range 0.4-94% for S. mansoni and 1-44% for hookworm).

Prevalence for S. mansoni was as high as 49.9% among 891 boys attending public schools which were using surface water source in the irrigation area while this was as low as 4.3% among girls attending private schools with no surface water source in non-irrigation area.

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The load of parasite eggs available to contaminate the environment is important for transmission of parasitic infections and this is generally attributed to a section of the population having heavy infection [17]. In the current study, significantly higher mean egg count and risks of infection were observed in children within the irrigation area than outside (9.50 EPG vs 1.68 EPG, p<0.01). Schistosoma infection in rice non-growing regions could also be attributed to labour migration. Child labour becomes very handy especially during December school breaks, which coincides with planting season. Many children from within and outside rice growing areas become involved in rice farming activities thus increasing the risk factors in children and the potentials of transporting the parasites to none irrigation regions [19,20]. Similarly, water from primary canals passing through rice non-growing areas to the paddies is at times used to irrigate horticultural crops [14] hence increasing transmission risks S. mansoni.

Hookworm infection rates were significantly higher in children attending schools in non-irrigation area (odds ratio of infection of no-irrigation to irrigation, 1.591, 95% CI; 1.413-1.791).

Table 6: Results of logistic regression analysis of hookworm infection among school children in Mwea Division, Central Kenya

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>S.E.</th>
<th>Sig.</th>
<th>Exp(B)</th>
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<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0</td>
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<td></td>
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<tr>
<td>Water source</td>
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<td>0.003</td>
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<td>0.544-0.882</td>
<td></td>
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</tr>
<tr>
<td>Irrigation</td>
<td>0.464</td>
<td>0.06</td>
<td>0</td>
<td>1.591</td>
<td>1.413-1.791</td>
<td></td>
<td></td>
</tr>
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<td>Gender</td>
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<td>0</td>
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<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-0.604</td>
<td>0.376</td>
<td>0.108</td>
<td>0.546</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
elserwhere reported that hookworm eggs and larvae survive well in loam type of soil than in clay type where they easily suffer desiccation [21,22]. High prevalence of hookworm infection could also be associated with continuous interaction with the soil during horticultural crop farming activities which occur all year round along the main irrigation canals [14].

Ascaris lumbricoides and T. trichiura were recorded in small number of the school children and with no significant difference. The mode of transmission of these two parasites is through ingestion of faecal contaminated vegetables and other food stuff, unlike in hookworm infection which is contracted via skin penetration by the larval stage.

All intrinsic factors of transmission and being equal, the observed difference in the prevalence in these helminths could be related to the mode of transmission. The habit of consumption of raw or insufficiently cooked vegetables associated with A. lumbricoides and T. trichiura infections is not common in this community. However, it is difficult to explain the findings considering the general use of canal water for domestic consumption in the villages. Other studies from Southeast Asia countries reported varying rates of infection in different environmental conditions where prevalence rates as high as 63% for T. trichiura and 49% for Ascaris lumbricoides were observed [23-25]. Such high rates of infection could be attributed to utilization of raw night soil by farming communities [26] but this practice does not occur in this region.

Poor sanitation and poor accessibility to safe water were significantly related to high infection rates in public schools. The average number of school children was four-fold higher in public schools than in private schools (558 vs. 133, p < 0.001) and there was congestion in the average number of children using a single toilet in public schools compared to those in private ones (33 vs.24 children, p<0.089) [NM.,Personal communication]. Poor latrine and congestion in the number of children using a single latrine could lead to misuse of the facility thus increase transmission of the infections. Such risk factors are important to consider in planning the intervention measures.

Odds ratio analysis of all the variables considered in the present study significantly contributed in the transmission of infections. Such heterogeneous dynamics in the transmission of schistosomiasis need to be considered for any successful control strategies [27]. Various control initiatives were tried in different schistosome and helminths endemic communities but most of them, were based on repeated treatment strategy alone, and lacked long term effects [12,28-30]. Strategies which involve change in human behaviour were found to have long term effects [31-33]. According to WHO, deworming of school children is an important control method of transmission of the infections in endemic communities [12] but integrated interventions could have long term effects in the community. Integrated interventions approach is therefore recommended for control of polyparasitism in Mwea.

This data was collected a number of years back and repeated treatment was initiated immediately [34]. Many such initiatives have been conducted in different places with varying degree of success but without ability to sustain such a programme, the infection rate soon goes back to pre-treatment levels or higher and this is more or less the picture currently seen in Mwea. This paper has elucidated the heterogeneities of the dynamics of transmission in Mwea hence advocating for an integrated method of approach of control of the infections.

Acknowledgements

The authors are thankful to the Director, Kenya Medical Research Institute for his permission to publish this work, to the Japan International Corporation Agency (JICA) for financially supporting the project under Eastern and Southern Africa Centre of International Parasite Control (ESACIPAC), to Kirinyaga District local authorities and District Education officer. The authors are indebted to the AEO, Mwea Division Mr. Ngonjo, the School Heads and the Mwea community without whom this project could not be possible.

References

Evaluation of glycolytic inhibitors as potential anti-HIV agents

Nzau B, Ng’ang’a Z, Kiptoo M, Oliveira M, Wainberg M, Songok EM

Abstract

**Background:** Glycolytic inhibitors lonidamine (LND) and 2-Deoxy-D-glucose (2-DG) have successfully been utilized primarily in combination with chemotherapy in the management of cancer patients. HIV highly exposed but persistently seronegative commercial sex workers were shown to have a significantly lowered glycolysis rates suggesting that reduction of cell glycolytic activity may be protective or beneficial against HIV Infection. LND and 2-DG effects as potential anti-HIV compounds have not been studied.

**Objectives:** To evaluate glycolytic inhibitors lonidamine and 2-Deoxy-D-glucose as anti-Human Immunodeficiency Virus type -1 compounds.

**Methods:** Viral Reverse Transcriptase (RT) was measured from culture supernatant using RT assay in pretreatment (4hr drug exposed followed by 2hr virus infection) and co treatment (drug and virus added in unison). Cell cytotoxicity on mock infected C8166 cells done in parallel with RT assay using Trypan blue exclusion test and Vi-cell (Beckman counter) cell viability analyser. Results obtained were normalized and presented as percentages.

**Results:** Lonidamine co treatment at 100 µM resulted in more than 76% HIV inhibition while 2-DG concentrations at 5mM had HIV inhibition percentage above 90% inhibition. Cell toxicity assessment at similar concentrations resulted in 75% reduction in actual cell count with LND co treatment. The 2-DG component maintained a cell proliferation of more than 90%.

**Conclusion:** These results demonstrate the potential anti-HIV activity of glycolytic inhibitors 2-DG and LND. However it suggests a better safety profile of 2-DG at effective inhibitory concentrations.

**Keywords:** Glycolytic inhibitors, LND, 2-DG

Introduction

Since Human Immunodeficiency Virus (HIV-1) was identified as the causative agent for AIDS [1] more than 34 million people worldwide have been infected and nearly half of these individuals have died.
was approved by the Kenya Medical Research Institute Scientific Steering Committee and Ethical Review Board (Ref. KEMRI SSC No. 1729).

**Cell:** C8166 cell line, a human CD4+, CD3+, T-lymphoblastoid cell line derived by the fusion of primary human umbilical cord blood T cells with a T-cell line derived from an adult lymphoid leukaemia that produced human T-cell leukaemia virus type-I (HTLV-I) was employed in this study to determine MOI, viral reverse transcriptase (RT) measurement and toxicity test. The C8166 cells were a donation from University of Manitoba, Department of Medical Microbiology.

**Cell culture:** C8166 were cultured and underwent several passages using RPMI 1640 media plus 10% (v/v) fetal calf serum and 1% Penicillin/streptomycin. Incubated at 37°C / 5% CO₂, and used hemacytometer (improved Neubauer) to determine the number of cells in culture. Cells were used once 80-100% confluent was achieved.

**Virus infectivity assay:** Co-treatment was (simultaneous addition of drug and virus) carried out and samples were taken from mock-infected (uninfected) cells and cells exposed to virus after 4 days incubation. Pre-treatment was also done in which cells were exposed to the drugs for a total of 4 hrs and MOI 0.5, HIV-1 IIIB for 2 hrs after which time cells were washed free of the drugs and virus. The cells were then incubated in RPMI 1640 under the identical conditions and cells densities employed by others. Cells were grown in RPMI 1640 media supplemented with 10% (v/v) fetal calf serum, 100 U/ml penicillin and 100µg/ml streptomycin. Cells were kept at 5% CO₂ in a humidified incubator (100% relative humidity) at 37°C.

**Drugs:** 2-DG and LND were purchased from Sigma Aldrich (Oakville, Canada). 2-DG was dissolved in sterile double distilled H2O to give a stock concentration of 100mM while LND was dissolved in dimethyl sulfoxide (DMSO) to give a stock concentration of 10mM and both stored at 4°C. Dilutions from the stock solutions were made prior to the addition of the drugs to the experimental cultures. Efavirenz purchased from Sigma Aldrich (Oakville, Canada) was used as the reference drug in ensuring HIV-1 used is potent and competent to infect C8166.

**Reverse Transcriptase Assay:** The Reverse Transcriptase (RT) activity was determined as described elsewhere [13]. Briefly, the screening procedure involved the use of tritium labeled thymidine triphosphate as the enzyme substrate and polyadenylic acid, oligodeoxythymidylic acid (poly(rA).p(dT) as the template primer dimer. The reaction product produced human T-cell leukaemia virus type-I (HTLV-I) was measured by the trypan blue exclusion test and Vi-cell (Beckman counter) cell viability analyser [14]. Briefly, 5 × 10⁴ and 5 × 10⁵ C8166 cells were seeded in a round bottomed 96 Nunc plate for co treatment and pre treatment respectively.

**Results**

To determine the effects of the glycolytic inhibitors 2-DG and LND, C8166 cells were infected with 0.5 MOI of HIV-1 IIIB and exposed to escalating doses of the drugs *in vitro* and RT assay was performed to evaluate what effect, if any, the drugs had on HIV replication/infection. On day four formation of syncytia was observed. A continuous presence of 2-DG and LND showed reduced RT values but also elevated levels of toxicity. From an average of duplicate values, LND at 1µM concentration had a 76% HIV inhibition with 52% cell viability (Figure 1) while in pre treatment the some concentration had 48% HIV inhibition and 84% cell viability. Co treatment with LND at 100µM resulted in > 90% HIV inhibition with 75% toxicity. A 62% HIV inhibition was observed with 47% cell viability in similar concentration following pre treatment (Figure 2). LND pre treatment at 5µM resulted in 60% HIV inhibition based on RT assay with a cell count of 79%.

![Figure 1: HIV inhibition based on RT assay and cell count on mock infected cells.](image)

After 4 days incubation period of C8166 cells with a tenfold serial dilution of LND and HIV-1 IIIB MOI 0.5 (co treatment) resulted in HIV inhibition from 64% to more than 90% with a cell count percentage of 52-25%. Average RT assay and cell count was obtained from triplicate and duplicate wells of each concentrations respectively and values normalized and presented in percentages.

![Figure 2: RT assay and cell count presented as percentage following pre treatment of cells with LND.](image)
1 IIB infectivity at MOI 0.5 (Pre treatment) incubated for 4 days. Pre treatment had a decreased HIV inhibition with an increase in cell viability, notably 1µM had a 48% HIV inhibition with a 84% cell proliferation. A 62% HIV inhibition with 47% cell count was recorded at 100µM. In both pre treatment and co treatment LND was dose independent.

Similarly 2-DG at 1 mM concentration had HIV inhibition values of 80% with more than 90% cell viability, 2-DG compound concentrations of more than 1mM were however more potent in HIV inhibition but increased cell toxicity (Figure 3).

Figure 3: Glycolytic inhibitor 2-DG effect on HIV-1 infected C8166 cells and cell proliferation

Each well was initially seeded with 50,000 cells in a 96 well plate treated with 2-DG and inoculated with HIV-1 IIB and after 4 days incubation period 5mM concentration and above resulted in 90% HIV inhibition but with a cell viability of less than 40%. Notably 1mM gave a reverse transcriptase inhibition of 80% and cell viability of 91%.

Pretreatment of C8166 cells with 2-DG showed a much lower HIV inhibition based on the RT assay (44% RT at 50 mM conc). The cell viability was however much higher (69%) following pre treatment as compared to co treatment (Figure 4). The RT assay was performed in triplicates and cell count in duplicates for each of the concentration used. The RT values recorded show 2-DG to be dose independent.

Figure 4: HIV inhibition following 2-DG pre treatment and cell count after 4 days incubation

Pretreatment of cells with 2-DG lead to both an increase in cell count (above 60%) and RT value (above 50%). The lowest value of HIV inhibition recorded was 44% at 50mM having 69% cell count.

The two compounds having shown a high HIV inhibition based on RT assay percentage also had a considerable reduction in cell viability of less than 50%. Cytopathic Effect (CPE) was observed at highest (100 µM / 50mM) concentrations used in each set of experiment reducing cell viability by up to 80% in both LND and 2-DG co treatment. The cell viability count was an average from duplicate set of wells obtained from mock infected cells. Both LND and 2-DG had a dose independent pattern in regards to the RT assay and cell viability obtained results.

Discussion

Lonidamine (LND) and 2-Deoxy-D-glucose (2DG) are effective glycolytic inhibitors which have shown inhibition of HIV-1 infected cells in vitro by 2-DG at 1mM co treatment and LND 5µM pre treatment. This is an encouraging finding and calls for the determination of the mode of the exact antiviral action of LND and especially 2-DG previous studies describe [15] the ability of 2-DG to inhibit cell fusion, glycolysis and all other apparent cytopathology resulting from infection by Newcastle disease virus and herpes simplex virus type 1. This data is clearly of interest not only in the study of their molecular biology, but also in possible new approaches to viral chemotherapy.

While little data has been published on the antiviral activity of LND, fundamental and clinical studies have found that 2-DG has unique potential as a rational and effective chemotherapeutic agent in the treatment of genital and ocular herpes. In addition 2-DG can potentially be administered systematically for generalized herpes viremia and/or encephalitis [16]. A previous study conducted by Caro et al [17] found that acute HIV infection of H9 cells led to increased cellular transport activity and Glut 3 transporter content while chronic HIV infection exhibited no significant differences in sugar transport in any of the cell types investigated whether log or stationary phase cultures were employed. The results of this study showed less than 55% cell viability in mock infected C8166 cells with glycolytic inhibitor LND at various concentrations following co treatment. 2-DG also at concentrations above 5mM resulted in cell growth of below 30%. These results are similar to a study by Xi et al [18] that showed 2-DG kills select tumor cell lines, including 1420 cells growing under normal oxygen conditions and that 4mM concentration for 72 hours was toxic to the cells. In another study [19] HIV-1 infection of H9 cells were observed and on days 1 and 2 post infection, the rates of 2-DG uptake in the uninfected and infected cells were virtually the same. However, by day 3 glucose uptake had increased 1.5-fold over that in the controls and by day 4 the rate was 2.0-fold higher in the infected cells. Pre treatment resulted in cell proliferation of above 60% in both LND and 2-DG mock infected cells. Selective toxicity of 2-DG has been observed for other cells and is based on the cells ability to phosphorylate 2-DG. However, 2-DG is seen to not only interfere with the glycolytic pathway but also other molecular systems [20-22].

The study established Reverse Transcriptase (RT) inhibitory activity by 2-DG at 1mM co treatment and LND 5µM pre treatment with cell viability above 70% in both. This would be an area to further research on immune activation in primary peripheral blood cells using primary HIV-1 strains. Lonidamine concentrations...
that have an equally destructive effect on C8166 cells as well as HIV-1 IIIIB should not be discarded. This dual activity could be advantageous, such as activity against HIV positive semen, as an antispermatogenic agent.

T cells use glucose and glutamine as their primary fuel source hence activated T cells have an increased metabolic requirements provided by glycolysis [23]. Emphasis should be made on host genetic factors have a major impact on the pathology of infectious diseases in humans. These genetic differences between populations studied could be a determinant of the variability in the results obtained [24]. Comparative effects of these glycolytic inhibitors on proliferation response, viability and other cellular characteristics in HIV infected cells therefore need to be investigated in detail.

Competing interests
The authors declare that they have no competing interests.

Acknowledgements
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References

Original Research

Impact of sanitation improved school latrine on latrine-related practices, perceptions attitude and occurrence of diarrhoea in children in Mwea Division, Kirinyaga District, Central Kenya

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Abstract

Background: School latrines in Mwea irrigation regions are unsanitary and unhygienic. School children who are the end point users of the latrines are exposed to the unhygienic conditions of the latrines and are likely to contract sanitation related diseases. School children have their outlook on the sanitation of the school latrines and they can play an important role towards programmes for improvement of sanitation in the school latrines. 

Objective: To determine children’s perception attitude and practices about the school latrines in relation to their health experiences. 

Methods: A self-administered questionnaire was conducted from 215 Grade Three children in three primary schools in Mwea Division of Central Kenya. Questions about washing hands after latrine use, cleaning of latrines, avoiding use of latrines and perceptions about dirty latrines in relation to occurrence of diarrhea were asked. Occurrence of diarrhoea was based on child’s recall of the experience during the one week preceding the day of the test. 

Results: Diarrhoea was experienced by 23% of children occurring more often in boys (29%) than in girls (17%). Children who perceived school latrine to be dirty developed diarrhoea (29%) more often than those who did not (18%). Diarrhoea occurrence was reported more frequently by children whose response was negative for washing hands after latrine use (28%) than those who did (15%). Children who felt that cleaning school latrines was a punishment developed diarrhoea (41%) more often than those who did not (18%). On the other hand, there was no significance difference in occurrence of diarrhoea in association with avoidance of usage of school latrines, cleaning of school latrines, and willingness to clean the school latrines. 

Conclusion: The school children have given a low rating of the sanitary condition of the school latrines. They are the end point users of school latrines and their outlook on the condition of the latrine in relation to their health is important for implementation of disease intervention measures.

Introduction

Faecal contamination is one of the most serious environmental health problems in poor countries mainly due to poor or lack of latrines in the communities and schools and it is associated with high morbidity and mortality especially in diarrhoeal diseases[1]. Diarrhoea could be bacterial, viral or parasitic in origin and latrines could provide a good source for the associated pathogens[2]. Soil transmitted helminths (STH) and Schistosoma mansoni are co-endemic in Mwea rice growing area region in Mwea Division, Central Kenya[3]. 

Unpublished data on sanitation of school latrines in the Division (I. Mwobomboia) reported more than 50% of the schools in the Division to be poor and unhygienic. Similarly there was a positive correlation between high infection rates and poor latrine sanitation in school (N. Muhoho. Personal Observation). It was therefore important to initiate a latrine improvement programme on community participation basis as part of integrated parasite interventions [4,5].

Although children are the end point users of the school latrines, they are usually ignored in terms of their desires to have good sanitation facilities. Although there are numerous studies on the importance of improved latrine sanitation [6-8] not much data is available on pupil perception, attitude and practices on the latrines in association with health effects on children, which is the subject of this study. The current paper therefore examines children’s perceptions, attitude and practice before and after introduction of sanitation improved latrines and assesses the association of the children’s responses with occurrence of diarrhoea in Kirogo, Kangai and Nyangati Primary schools where the model improved sanitation latrines were constructed.

Materials and Methods

Site of study: The study was conducted in Mwea Division where soil transmitted helminths infections and intestinal schistosomiasis are co-endemic. Poor sanitation in school latrines was partly associated with transmission of
the infections. There are three school zones in the Division, namely, Mutithi, Murinduko and Thiba zones, respectively and the pattern of infection was examined according to the school zones for the purpose of this study.

Study design: School latrine improvement programme was initiated as one of the strategy for integrated parasite interventions in the region. It was necessary to construct a “Showcase” model latrine in each of the three School Zones in the Division for other schools to emulate. Kirogo Primary School in Thiba School Zone, Nyangati School in Murinduko, zone and Kangai School in Mutithi school zone were selected for the showcase latrines. These schools were selected on the basis of high infection rates in the school children, poor sanitation of the latrines and easy access from the main road for the purpose of transportation of construction materials. Kangai Primary School was situated about a kilometer from the nearest stream from where the children drew water for the school use, Kirogo school was about 500 meters from the primary water canal while a water furrow ran just adjacent to the school latrines in Nyangati school (Figure 1).

Figure 1: Children playing in the canal water which is just adjacent to the school latrines

The study on the responses of the children before and after introduction of the model latrines was done for Kirogo and Kangai with a sample of 165 school children due to some technical problem that resulted in a total destruction of the structure in Nyangati school a week before handing it over to the community (It is appreciated that the community came back and put up another structure- Figure 2).

Figure 2: School latrine before and after introduction of sanitation improved latrines

The model latrines were constructed on the basis of shared responsibility where the community provided labour while material support and advice on construction came from the collaboration of the Japan International Cooperation Agency (JICA) and the government of Kenya.

Characteristic of the model latrine: The design of the model latrine was such that it must be a permanent structure made of stone block and cement, it must have hand washing water facilities, easy to maintain sanitation wise and one that meets the government recommended pupil/toilet ratio of 30:1 plus a urinal for boys and 25:1 for girls. To slow down or to prevent filling up of the latrine, the biodigester “Effective Microorganism” or EM was to be used to digest the solids and allow grey water to soak underground. EM is locally available in the agro-vet shops [9]. Grey water can also be used for farming in the school gardens.

Questionnaire study: The questionnaire was set up to assess the children on their perception, attitude and practices on the latrine and in relation to their health. A sample of 215 Grade 3 (9 – 12 years) children, 97 boys and 118 girls; 81 in Kirogo, 81 in Kangai and 53 in Nyangati schools were recruited and tested using a self administered questionnaire under the supervision of the class teacher two months before introduction of the model latrine. The children were also asked to recall if they had diarrhoea in the last one week preceding the test. Comparisons were made for association of the children’s responses and the occurrence of diarrhoea.

Data analysis: Data entry was performed in Microsoft Excel (version 10). Statistical analysis was conducted with Epi Info (Version 3.2.2, CDC). Analysis for the frequency of latrine use was computed using t-test. P-value was calculated using Mantel-Hanszel of Fisher exact test

Results

Table1 is the pattern of schistosoma mansoni and STH infections, sanitation state of the school latrines and the pupil/toilet ratio (per latrine doors) in Kirogo, Kangai and Nyangati school. The three schools had a deficit of 71 toilets shared between them. Sanitation of the latrines in the three schools was characterized as “very dirty” for Kirogo and Kangai schools but dirty in Nyangati.
Table 1: Model sanitation improved school latrines in three School Zones in Mwea Division, Kenya

<table>
<thead>
<tr>
<th>School zone/School</th>
<th>No. of pupils</th>
<th>Infection rates</th>
<th>Latrine Sanitation</th>
<th>No. of toilets required</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>Total</td>
<td>STH</td>
</tr>
<tr>
<td>Murinduko zone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nyangati</td>
<td>217</td>
<td>226</td>
<td>443</td>
<td>36.8</td>
</tr>
<tr>
<td></td>
<td>21.7</td>
<td>22.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mutithi zone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kangai</td>
<td>507</td>
<td>451</td>
<td>958</td>
<td>28.8</td>
</tr>
<tr>
<td></td>
<td>63.4</td>
<td>43.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thiba zone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kirogo</td>
<td>363</td>
<td>323</td>
<td>686</td>
<td>22.5</td>
</tr>
<tr>
<td></td>
<td>45.4</td>
<td>53.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total short</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 is the association of children’s perception attitude and practices and diarrhoea occurrence in the three model latrines in the study area. In total, 22% of the children (45 out of 215) reported to have had diarrhoea in the week preceding the test. Boys demonstrated significantly higher association than the girls (29% vs. 17%, p < 0.05). Hand washing after using school latrines, feeling that the latrines were dirty (15% vs. 28%, p < 0.05), perceptions that school latrines were dirty (29% vs. 18%, p < 0.050) and the feeling that cleaning of school latrines was a punishment (18%, p< 0.001) significantly influenced diarrhoeal occurrence in children. However, there was no significance associated with occurrence of diarrhoea and the practice of cleaning of the school latrines, avoiding use of school latrines and children’s willingness to clean school latrines.

Table 2: Association of variables with diarrhoeal occurrence in children on standard three model schools- Kirogo, Kangai and Nyangat schools in Mwea Division, Kenya

<table>
<thead>
<tr>
<th>Variables</th>
<th>(n=215) (%)</th>
<th>Diarrhoeal occurrence association (%)</th>
<th>P-value</th>
<th>Odds ratio (95%CI*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>45.1</td>
<td>29</td>
<td>0.037</td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>54.9</td>
<td>17</td>
<td>1.99 (1.04-3.81)</td>
<td></td>
</tr>
<tr>
<td>1. Do you wash your hands after using the school latrine?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>41.4</td>
<td>15</td>
<td>0.024</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>58.6</td>
<td>28</td>
<td>0.45 (0.22-0.90)</td>
<td></td>
</tr>
<tr>
<td>2. Do you feel school latrine is dirty?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>41.9</td>
<td>29</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>58.1</td>
<td>18</td>
<td>0.53 (0.28-1.01)</td>
<td></td>
</tr>
<tr>
<td>3. Do you think school latrine has any problem?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>89.0</td>
<td>28</td>
<td>0.145</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>21.0</td>
<td>18</td>
<td>1.72 (0.90-3.28)</td>
<td></td>
</tr>
<tr>
<td>4. Did you clean the school latrine anytime in this month?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>19.5</td>
<td>75.3</td>
<td>1.11 (0.50-2.46)</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>80.5</td>
<td>24.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Are you willing to clean the school latrine?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>75.3</td>
<td>20.4</td>
<td>0.949</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>24.7</td>
<td>79.5</td>
<td>0.98 (0.47-2.05)</td>
<td></td>
</tr>
<tr>
<td>6. Is cleaning school latrine a punishment?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>20.4</td>
<td>40.9</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>79.5</td>
<td>17.5</td>
<td>3.25 (1.59-6.68)</td>
<td></td>
</tr>
<tr>
<td>7. Did you have diarrhoea in this last week?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>45.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>17.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3: Perceptions, attitude and practice before and after introduction of sanitation improved school latrines

<table>
<thead>
<tr>
<th>Variables</th>
<th>Percentage of “Yes” answer (n=154)</th>
<th>Odds Ratio (95%CI)</th>
<th>P-value**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washing hands after latrine’ use in school</td>
<td>27.9/85.7</td>
<td>15.49 (8.43-28.69)</td>
<td>0.000</td>
</tr>
<tr>
<td>Having cleaned school latrine</td>
<td>13.6/94.8</td>
<td>115.58 (46.52-298.57)</td>
<td>0.000</td>
</tr>
<tr>
<td>*Frequency of school latrine’ use</td>
<td>1.85 (0.97)/2.95 (1.16)</td>
<td>-</td>
<td>0.011</td>
</tr>
<tr>
<td>Avoidance of school latrine</td>
<td>42.9/1.9</td>
<td>0.03 (0.01-0.09)</td>
<td>0.000</td>
</tr>
<tr>
<td>Perception of any problems in school latrine</td>
<td>88.3/2.6</td>
<td>0.00 (0.00-0.01)</td>
<td>0.000</td>
</tr>
<tr>
<td>Perception for cleanliness of school latrine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean &amp; fair</td>
<td>60.4/99.4</td>
<td>100.35 (14.66-1981)</td>
<td>0.000</td>
</tr>
<tr>
<td>Dirty</td>
<td>39.6/0.6</td>
<td>0.03 (0.00-0.21)</td>
<td>0.000</td>
</tr>
<tr>
<td>Perception of “cleaning school latrine is punishment”</td>
<td>18.2/0.6</td>
<td>0.21 (0.09-0.44)</td>
<td>0.000</td>
</tr>
<tr>
<td>Diarrhoea in last week</td>
<td>27.3/7.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Mean of frequency (standard deviation) and statistical analysis based on t-test

**P-value was calculated with Mantel-Hanszel or Fisher exact test

Because children were referring to school latrines of their own, analyses were also done based on individual schools (Not in the table). Diarrhoea occurrence was recorded more often in Kangai school (35%) followed by Kiromo school (21%) and only 6% of children in Nyangati school. Nyangati school had the highest proportion of hand washing (87%) while this was 35% in Kangai School and 19% in Kiromo. Nyangati school had the highest proportion of children cleaning school latrines (42%) vs. 15% and 10% in Kangai and Kiromo schools, respectively and the highest proportion of children feeling that cleaning school latrines was punishment (32%) compared to 20% in Kangai school and 14% in Kiromo respectively.

Pre-test and post-test analysis of children’s perceptions, attitude practice and experience of diarrhoeal episodes was done in Kiromo and Kangai, involving 154 children, 74 girls and 80 boys, only (Table 2). Eleven of 165 children registered were excluded from the study because of absenteeism. Mean age was 10.3 (SD 2.0, 7-14) for boys and 10.0 (SD 2.0, 7-15) for girls. Questionnaire data collected two months after introduction of the sanitation improved latrine demonstrated significant improvement in all parameters tested. Only 2.6% of the children reported any type of problem in the new latrine as opposed to 88.3% recorded pre-test. There was a 75% reduction in the recalled incidence of diarrhoea episode, 27.3% -pre-test vs. 7.1% -post test, respectively.

Discussion

Children are never consulted in the matters of school latrine and sanitation despite the fact that they are the end point users. The findings in this study gave poor ratings of school latrines by the children and there was significant association of children’s responses with the occurrence of diarrhoea. The data after two months of using the new sanitation improved latrine demonstrated a remarkable shift of the children’s perceptions, attitude and practices, in a way saying they got what they always desire.

First stage of the study looked at the children’s outlook of unsanitary latrines in association with diarrhoea as an indicator of health problems, looking at the data of the three model schools, namely Kiromo, Kangai and Nyangati primary schools (215 children). The second stage of the study compares the perceptions, attitude and practice before and after introduction of the model latrines in Kiromo school and Kangai school (154 children) due to a technical problem experienced in Nyangati school. Flash rain storm water caused a diversion of the irrigation canal water into the latrine under construction and completely destroyed the structure, to the utter disappointment of the parents. Nevertheless, the parents came back and contributed for the second structure (Figure 1).

Study on occurrence of diarrhoea was based on child’s recall of the experience of the week preceding the study and no laboratory or clinical investigations were required.
There was a clear association of children’s perceptions and attitude about unsanitary latrines and their recall of diarrhoea occurrences. There are reports that unsanitary school facilities could be potential sources of hepatitis A outbreaks and other diseases[10]. School children in the current study painted a grim picture of the latrines and the data gave significant association with diarrhoea occurrences in children, which was higher in boys than girls, 29% and 17%, (95%CI) 0.0371.99 (1.04-3.81) p<0.05. Dirty unsanitary latrines could cause contamination of hands resulting in diarrhoeal related diseases. In the present study, failure to wash hands (58.6% of the children) and feeling that the latrines were dirty(41.95% of the children) were significantly associated with reports of diarrhoea occurrence. 27.8% vs. 14.6% and 28.9% vs. 17.6, P< 0.05). However, there was no significant association of occurrence of diarrhoea in children who avoided using school latrines and those who did not (27.7% vs. 18.2% P < 0.05) probably because of reduced frequency of visits to the unsanitary latrines. Poor sanitary conditions of school latrines make children avoid using school latrines and this would have health implications [11]. By avoiding using the school latrines during the school days, the child increased the risks of urinary tract infection and constipation [12-14]. In this study, improved school latrines increased the frequency of latrine use while the number of children avoiding using the facility declined.

The association between stool disposal and child diarrhoea has been investigated in a number of epidemiological studies. Defecation near home or in living areas was associated with an increased incidence of diarrhoea [15-17]. Pathogen positive diarrhoea was reported to increase by 63% in families where children’s stools were inadequately disposed. Such pathogens could be the source of bacterial viral or parasitic pathogens [18]. Any of these pathogens could be associated with the diarrhoea reported in our study.

Open defecation around the latrines and mounds of faeces on the toilet floor were a common observation in the study latrines in the current study especially those used by lower classes. Floor of most of such toilets were also soiled with mound of faeces apparent. Such soiled floors obviously forced some children to defecate around the periphery of the structure (no data shown). The other observation was that, the boys’ latrines were more dirty than those of girls hence higher risks of contracting diarrhoea.

Comparison of data before and after the introduction of the sanitation improved school latrine demonstrated a significant improvement in all study parameters post-test where 88% of the children reported to have no complaints about the toilets. This was a new learning experience in the children and it is hoped that the school could develop a mechanism to sustain latrine sanitation. Poor sanitation and inadequate access to safe water adversely affect the health and socioeconomic development of communities [19] especially when parents would have to lose working time to take care of the health of the child.

Diarrhoea episodes during childhood and adolescence can eventually lead to lower fitness and decreased productivity as an adult [20].

Dirty latrines, and open holes in the latrine walls could make children avoid using the facility, especially girls [11,21]. A large number of children reported to avoid usage of the latrine and this corresponded with the number of those who reported the latrines to be dirty as well as those who reported to experience diarrhoea before introduction of the model latrines (42.9 vs. 1.9, 95% CI (0.03 (0.01-0.9) P<0.005).

When the data was considered according to individual schools Nyangati school, had the highest level of usage of hand washing water and this could be explained by the proximity of the canal water to the latrines. This water was not part of the latrine but it was readily available to the children for washing hands after latrine use and washing latrines. Constant washing of hands could also reduce diarrhoeal incidence.

**Notation**

Due to some unavoidable circumstances JICA pulled out from the project just before we could bring sanitation education to the community and it was not possible to roll out the model latrine initiative to other schools. Not much has changed since in the sanitation of the school latrines. I coordinated the programme and we were in the right direction to mobilize the community. The community was willing and ready to effectively play its part through the board of school management and the support of the government. A successful programme could lead to rolling out a national programme where the government and other donors as well as the local community would be involved. It did not happen, to the disadvantage of the child.

**Acknowledgements**

This study was supported by Japan international corporation agency/International Parasite Control Project (JICA/IPC) and the Government of the Republic of Kenya. We would also like to thank all the children, the community members, headmaster and teachers who were involved in this programme. Thanks are also extended to Mr. Joseph Ngongo (Area Education Officer) and Mr. Fredrick Kariuki (Public health officer) in Mwea Division, Kirinyaga District for supporting this programme. We appreciate Prof. Kazuhiko Moji from Institute of Tropical Medicine, Nagasaki University for his useful comments on the manuscript.

**References**


Clinical and histopathological audit of head and neck rhabdomyosarcoma at the University of Nairobi Dental Hospital pathology laboratory

Chindia ML, Otwoma JG, Awange DO, Dimba EA, Limo AK, Wakoli KA

Abstract

Background: Rhabdomyosarcoma (RMS) is an important disease of childhood and adolescence comprising 4 to 8% of paediatric cancers and is the most common sarcoma of childhood. Numerous cases have been treated in Kenya but little or no related data have been published.

Objective: To document the demographic characteristics of cases of head and neck RMS diagnosed over a period of 15 years.

Study site: The study was conducted in the University of Nairobi Dental Hospital (UNDH) pathology laboratory.

Methods: This was a retrospective study over fifteen years (1995 to 2010). Clinical notes and the histopathology reports based on the Haematoxylin and Eosin (H&E) staining technique were studied and categorized according to gender, age and the site of lesion.

Results: The caseload accessed during the time of the survey were 21 patients among whom 57% were female and 42.8% male with no significant difference (P≤0.05). The age range of the patients was 2.5 – 61 years, mean=23.5 years. Young age groups ≤ 20 years were more affected (47%) than the older groups. Presentation of RMS did not show any particular site predilection in the orofacial area although the mandible and the cheeks were more favourable sites.

Conclusion: RMS though a rare disease was diagnosed in 21 patients within a period of 15 years.

Introduction

Rhabdomyosarcoma (RMS) is an important disease of childhood and adolescence comprising 4 to 8% of paediatric cancers and is the most common sarcoma of childhood [1,2]. RMS is a malignant tumour of mesenchymal origin that arises from immature cells destined to form striated skeletal muscle. This disease can also occur in a variety of tissues including non-striated muscle and have been reported to occur in the liver, brain, trachea, heart, breast and ovary[3-5].

The common sites where RMS occurs include the head and neck, extremities and the genitalia - urinary system. In the head and neck area, the orbit is the most common site of occurrence followed by the tongue and soft palate.

Published information regarding the incidence and pattern of occurrence of soft tissue sarcomas in general and RMS in particular is scanty in Kenya. In view of the high morbidity and mortality that is associated with this disease, regular documentation of its mode of occurrence in any population is of particular medical importance. It is in this regard that a retrospective study was conducted on the hospital records to elucidate the extent of RMS that presented at the University of Nairobi Dental Hospital (UNDH) in Kenya.

Materials and Methods

Patients’ data: The UNDH is an undergraduate and postgraduate teaching institution that provides tertiary oral healthcare services countrywide and regionally. The clinical case notes and laboratory records of all the cases of RMS seen in the hospital over a 15-year period (1995 to 2010) were accessed.

Information was then collated with respect to each case including the gender, age, site of lesion and treatment offered. All the cases had a diagnosis made earlier on the basis of the clinical manifestation, relevant imaging and the Haematoxylin & Eosin (H&E) staining technique of the biopsy specimens.

Results

This was a retrospective study over 15 years where 21 cases of RMS consisting of 57.1% females and 42.9% males were recorded at different sites of the head and neck (Table 1). The mean age of the patients was 23.5, (range 2.5 -61 years). RMS affected more young people, age group 1 - 20 years (47.6%) than the older groups (Table 2). When the lesions were grouped by the site of occurrence, most of them appeared in mandibular region (19.0%) and cheek region 19.0%, respectively (Table 3).
**Table 1:** Cases of head and neck rhabdomyosarcoma recorded in a period of fifteen years at University of Nairobi Dental Hospital by gender

<table>
<thead>
<tr>
<th>Lesion site</th>
<th>Distribution by gender (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Left maxillar</td>
<td>1</td>
</tr>
<tr>
<td>Right face</td>
<td>2</td>
</tr>
<tr>
<td>Left mandibular</td>
<td>1</td>
</tr>
<tr>
<td>Submandibular area</td>
<td>0</td>
</tr>
<tr>
<td>Right cheek</td>
<td>0</td>
</tr>
<tr>
<td>Left cheek</td>
<td>2</td>
</tr>
<tr>
<td>Right maxilla</td>
<td>0</td>
</tr>
<tr>
<td>Left bucal area</td>
<td>1</td>
</tr>
<tr>
<td>Left bucal space</td>
<td>1</td>
</tr>
<tr>
<td>Upper lip</td>
<td>0</td>
</tr>
<tr>
<td>Left mandible</td>
<td>0</td>
</tr>
<tr>
<td>Dorsum of tongue</td>
<td>0</td>
</tr>
<tr>
<td>Nasal mass</td>
<td>0</td>
</tr>
<tr>
<td>Left anterior mandibular</td>
<td>0</td>
</tr>
<tr>
<td>Left mandibular sulcus</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 2:** Head and neck rhabdomyosarcoma cases by site of lesion, age group and gender

<table>
<thead>
<tr>
<th>Age groups</th>
<th>Site of lesion</th>
<th>Gender</th>
<th>Age (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-5</td>
<td>Left maxillar</td>
<td>F</td>
<td>2.5 4.7</td>
</tr>
<tr>
<td>6-10</td>
<td>Right face</td>
<td>M</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Left mandibular</td>
<td>M</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Submandibular area</td>
<td>F</td>
<td>10   14.2</td>
</tr>
<tr>
<td>11-20</td>
<td>Right cheek</td>
<td>F</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Left cheek</td>
<td>F</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Right maxilla</td>
<td>F</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Left bucal area</td>
<td>M</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Left bucal space</td>
<td>M</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Left cheek area</td>
<td>M</td>
<td>20   28.5</td>
</tr>
<tr>
<td>21-30</td>
<td>Upper lip</td>
<td>F</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>Left mandible</td>
<td>F</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Dorsum of tongue</td>
<td>F</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Nasal mass</td>
<td>F</td>
<td>30   19</td>
</tr>
<tr>
<td>31 -40</td>
<td>Left anterior mandibular</td>
<td>F</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>Left cheek</td>
<td>M</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Right face</td>
<td>F</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Left mandibular sulcus</td>
<td>M</td>
<td>34   19</td>
</tr>
<tr>
<td>41-50</td>
<td>Left maxillary area</td>
<td>F</td>
<td>52   9.5</td>
</tr>
<tr>
<td></td>
<td>Right face</td>
<td></td>
<td>61</td>
</tr>
<tr>
<td>No data</td>
<td>Submandibular area</td>
<td>F</td>
<td>No data 4.7</td>
</tr>
</tbody>
</table>

**Table 3:** Cases of head and neck rhabdomyosarcoma by site of lesions gender/age

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age</th>
<th>Gender</th>
<th>State of lesion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>31</td>
<td>F</td>
<td>Left anterior mandibular</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>F</td>
<td>Left mandible 19.0</td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>M</td>
<td>Left mandibular</td>
</tr>
<tr>
<td>4</td>
<td>34</td>
<td>M</td>
<td>Left mandibular sulcus</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>F</td>
<td>Left cheek</td>
</tr>
<tr>
<td>6</td>
<td>32</td>
<td>M</td>
<td>Left cheek</td>
</tr>
<tr>
<td>7</td>
<td>20</td>
<td>M</td>
<td>Left cheek area 19.0</td>
</tr>
<tr>
<td>8</td>
<td>14</td>
<td>F</td>
<td>Right cheek</td>
</tr>
<tr>
<td>9</td>
<td>2.5</td>
<td>F</td>
<td>Left maxillar</td>
</tr>
<tr>
<td>10</td>
<td>16</td>
<td>F</td>
<td>Right maxilla 14.2</td>
</tr>
<tr>
<td>11</td>
<td>52</td>
<td>M</td>
<td>Left maxillary area</td>
</tr>
<tr>
<td>12</td>
<td>6</td>
<td>M</td>
<td>Right face</td>
</tr>
<tr>
<td>13</td>
<td>61</td>
<td>M</td>
<td>Right face 14.2</td>
</tr>
<tr>
<td>14</td>
<td>34</td>
<td>F</td>
<td>Right face</td>
</tr>
<tr>
<td>15</td>
<td>17</td>
<td>M</td>
<td>Left buccal area</td>
</tr>
<tr>
<td>16</td>
<td>17</td>
<td>M</td>
<td>Left buccal space 9.5</td>
</tr>
<tr>
<td>17</td>
<td>10</td>
<td>F</td>
<td>Submandibular area</td>
</tr>
<tr>
<td>18</td>
<td>-</td>
<td>F</td>
<td>Submandibular area 9.5</td>
</tr>
<tr>
<td>19</td>
<td>20</td>
<td>F</td>
<td>Upper lip 4.7</td>
</tr>
<tr>
<td>20</td>
<td>27</td>
<td>F</td>
<td>Dorsum of tongue 4.7</td>
</tr>
<tr>
<td>21</td>
<td>30</td>
<td>F</td>
<td>Nasal mass 4.7</td>
</tr>
</tbody>
</table>

**Figure 1:** Illustrates a gross buccal space lesion of RMS.
Figure 2: Fibrous septae separating clusters of neoplastic cells showing pleomorphic cells varying from the strap or requet-shape to rounded and avoid morphologies with characteristic remnant cross striations. (H&E, Magnification x 200). Features of RMS on silver staining.

There was no significant difference between variables, using one tailed test at 0.05 sign level. Figures 1 and 2 are the presentation of clinical and histopathological cases of rhabdomyosarcoma.

Discussion

This study has elucidated the incidence of head and neck RMS in one hospital in Kenya. Generally, this is a malignant neoplasm which constitutes a major problem in oral health. Late presentation and diagnosis, high mortality rates and morbidity arising from gross disfigurement and impaired function are characteristics of the disease. Morbidity and mortality rates are high, especially where primary care systems are poor and early diagnosis is hampered by ignorance and poverty. Approximately 40% of all RMS originate in the head and neck region; and of these 90% affect children [6,7].

The aetiology of RMS is centred on various factors including the association with several syndromes such as the neurofibromatosis 1, Rubinstein-Taybi, Beckwith-Wiedemann, Costello, Noonan and Gorlin basal cell nevus syndromes [3,8]. No specific aetiologic factors have been conclusively established in the pathogenesis of RMS. In the present series no attempt was made to establish any associated syndromes since the information collected was based on clinical and laboratory notes only.

In general, genetic and environmental factors are known to contribute to the development of sarcomas. In a resource starved setting, comprehensive management of RMS remains a great challenge. This tumour falls into the broad category of small round, blue-cell lesions of childhood that include neuroblastoma, Ewing’s sarcoma and lymphoma. The key components of the evaluation of a suspected RMS entail the determination of the extent of the primary disease and the existence or absence of metastatic disease. Furthermore, histological grade is known to be a reliable predictor of prognosis and, in fact, is a designated component of the American Joint Committee on Cancer Staging System for Sarcomas [1]. In view of the high metastatic potential of RMS, especially in the regional head and neck lymph nodes, appropriate imaging including magnetic resonance imaging (MRI) should be mandatory. However, where resources are inadequate this may not be feasible. In our survey, relevant imaging and the Haematoxylin & Eosin (H&E) staining technique of the biopsy specimens were conducted.

The presenting symptoms and signs of RMS are generally variable and may be influenced by the site of origin of the primary tumour, the age of the patient and presence of metastatic disease. Notably, three pathologic types of RMS have been described thus: the embryonal, alveolar and pleomorphic entities. The present investigation did not attempt to categorize the cases in this regard. While RMS is generally deemed a rare disease, it is still important to evaluate its rate and mode of occurrence in any population since its comprehensive management can be particularly resource-intensive.

Acknowledgements

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References

Abstract

Background: Solvent abuse (glue sniffing) particularly the inhalation of petrol, ethylated spirits, glue and other solvent products is a common practice among street families in Kenya. Reports from other countries show glue sniffing as a significant cause of mortality and ill-health among abusers but there is no data from Kenya. The pathological effects on the abuser have not been reported in Kenya and there is no policy to control the practice in the country.

Objectives: This paper aims to give detailed overview on the issue of glue sniffing and postulate the appropriate policy measures to curb the practice in Kenya.

Study selection: The focus of this study was on street families among whom the practice is rampant. These group share similar environmental conditions in the major cities in the country; thus, the problem could be evaluated appropriately. In addition, the study investigated the situation among the juvenile population.

Data extraction: Each study was keyworded for generic issues including study design, focus, language, country and population. Studies were also keyworded for topic specific issues such as intervention types, sites and the people providing the interventions.

Data synthesis: Glue sniffing is a significant cause of mortality and ill-health among street families. Therefore, it is an issue that requires medical concern; thus, healthcare systems should incorporate glue sniffing control measures in the health policy.

Conclusion: Glue sniffing requires attention from healthcare stakeholders, especially through health policy reforms to control the spread of the practice. It is believed that, glue sniffing bears correlation with drug abuse because most drug abusers are reported to have sniffed glue at one point in their lives. Therefore; the Kenyan Government should design appropriate measures to address the issue to eliminate its adverse impact on the society.

Key words: Volatile substance abuse, inhalation, intoxicating fumes, brain damage

Introduction

General drug abuse is an increasing problem world-wide that has not spared Kenya, where this has been most notably so on solvent abuse. Ordinarily, deliberate abuse of a wide range of volatile organic substances has been known to exist for many years. This was the first form of drug abused by habitual drug users [1,2]. In most cases, volatile organic substances are administered through sniffing -the inhalation of vapor with a view to euphoria. This practice goes under the names ‘Glue Sniffing’ (GF) or Solvent Abuse (SA). Volatile substance abuse (VSA) is more prevalent among younger male age groups, mostly 12-19 years. Many causes for the abuse have been reported most common being lack of parental care although this is mainly a collective responsibility of the society as a whole, as one magistrate remarked “The parents have no control, the Council have no control, and the Government has no control” [3].

Ordinarily, duration of use ranges between 2 and 12 years most of it being daily use. The abusers usually have difficulties obtaining the hard drugs therefore, they resort to VSA as a substitute. This is an indication that volatile substance abuse may herald the beginning of introduction to harder drugs among teenagers. There has been a link between drug abuse and criminal behavior; although, there is some evidence that drug abuse may be a part of contemporary delinquent behavior, rather than being the cause of criminality [2].

It appears that, wide spread availability of drugs during the past two decades has been evidenced by unprecedented increase in deaths related to drug especially among the teens. Drug abuse has become one of the leading causes of deaths of young people between the ages of 15 and 35 years, especially in the large cities worldwide [2,4,5]. Up to 10% of Kenyan school
students admitted to have drunk alcohol more than three times a week, 16% smoke cigarette more than three times a week, nearly 14% had smoked cannabis sativa (bhang) and 16% admitted taking other drugs especially tranquillizers to ‘feel high’. The use and abuse of other drugs especially cannabis sativa and alcohol by Kenyan school children is widespread and on the increase [6, 7]. Other drugs of abuse used in Kenya include heroin and cocaine to a lesser extent, especially in the coastal towns of Mombasa, Lamu, Kilifi and Malindi, Khat (Cath edulis) popularly known as ‘miraa’ in Kenya, is massively consumed around Meru, Mombasa and wide spread in some parts of Nairobi and North-Eastern province.

In general, solvent abuse particularly the inhalation of petrol, methylated spirits, glue and other solvent products occurs in Kenya and other African countries including Cameroon, Ethiopia, Mozambique, Nigeria, South Africa and Zimbabwe. In Kenya, solvent abuse is particularly associated with the street families in the urban areas, who inhale solvents very openly in the streets of Nairobi city and other large towns. This practice has been rampant because the inhaled solvents are cheap, easily available, easy to handle, and they are believed to give the desired euphoric state within very short time.

Some of the principal factors that influence the abuse of drugs in sub Saharan Africa include poverty, rural to urban migration, and its concomitants such as living in a slum, unemployment, single parenthood, lack of effective role of father, poor social adaptation, the availability of drugs, lack of adequate controls and peer pressure [3,4,6,7]. Despite the high death rates reported related to the use of the drugs in other countries, the information related to this problem is daunting in Kenya since few cases if any are reported to the police. Besides, no analysis is done for volatile substances or any other meaningful toxicological drug analysis. In regard to the terminologies used in toxicological issues of drug abuse, most of the terms used in drug abuse are popular and commonly misused especially in the press and media reports, which lead to unprecedented confusion among persons who are not directly involved in this practice. In this paper the following will be the definition of the terms as they are used in forensic science [8].

**Drug:** This is a term widely used in forensic sciences to mean any natural or chemical or combination of chemicals which when taken alters the body functions. **Addiction:** This is the compulsive desire to continue taking a drug with increased doses to the point of producing physical dependence. **Volatile substance:** Is a substance, which is capable of readily changing from a solid or liquid state to vapor i.e. one which has a high vapor pressure and a low boiling point (increased vapor pressure and low boiling point). **Volatile substance abuse (VSA):** This is a term used to mean a deliberate inhalation of intoxicating fumes given off by certain solvents or propellants solely for the purpose of intoxication. Other terms used synonymous to VSA are solvent abuse, glue sniffing and gum.

### Mode of volatile substance abuse

Drug abuse is a practice done in top secrecy; most of the modes used to get the drug into the body system differ from one drug to another depending on the form which is available in the market. Methods used include injection for narcotics such as heroin and cocaine, smoking for cannabis sativa, or oral intake like alcohol and tranquillizers. Unlike all other drugs of abuse, solvent abuse is not illegal in most countries including Kenya. To get the desired euphoric effect in these compounds; the vapor rather than the solvent solution is required for immediate effect for which this is done openly in streets without fear.

In general, all methods of volatile substance abuse involve deep breathing of the vapor through the nose and/or mouth. Volatile substances are usually abused using polythene or plastic bag or small potato crisps bag. In sniffing, the solvent is placed in a plastic bag or soaked in handkerchief or rag, and then the vapor is inhaled giving the desired intoxication. Either propellant volatiles such as butane or propane is sprayed directly from the aerosol tin into the oro-pharynx or into a polythene bag, which is then placed over the head and neck for the vapor to be inhaled [8, 9].

### Solvents commonly abused

The numbers of solvent substances abused, or those with potential for abuse depends on the availability and the local prevailing conditions. The commonly available substances for abuse world-wide include nitrous oxide, toluene, petrol products, gasoline, hydrogenated carbon, glue, acetone, benzene, propane, aliphatic hydrocarbon and xylene, ether, chloroform, trichloroethylene (doctors and nurses) and gasoline fumes of petrol products (glue sniffing).

### Effects of solvents abuse

The effects of VSA are widely variable depending on many factors such as the nature of the substance abused, the dose administered or the quality of the vapor inhaled, and most importantly; the duration or chronicity of the abuse [5,8, 9]. These can be divided into short-term and long-term effects:

(i) **Short-term effects and dangers of solvent abuse**

Inhaled vapors are readily absorbed through the respiratory tract while lipid soluble hydrocarbons cross the blood-brain barrier and rapidly reach the brain causing alcohol-like effects, such as euphoria. These compounds are normally CNS depressants after initial excitatory effect especially visual and auditory hallucinations and dysarthria. This is usually followed by general depression of the vital body functions such as the respiratory and the heart rate.
In general, volatile substances combine depressant and hallucinogenic effects. The first effect of inhalation is euphoria, followed by hallucinations, delusions, and then perception distortion, which may lead to aggressive and risk behaviour. The effects in the central nervous system following inhalation are dangerous and can cause death within a short time.

Effects that are more serious are central nervous effects such as disorientation, double vision, loss of control, ataxia, vagal inhibition, cardiac arrhythmia’s, unconsciousness and occasional convulsions or coma [2,7,10,11]. Vomiting, coughing, and sneezing may also occur at any stage [11].

(ii) Long term effects of solvent abuse
Apart from the general deterioration of the abuser’s health, there are effects of chronic use such as weight loss, depression, tremor, cerebral dysfunction, optic neuropathy, encephalopathy and brain stem dysfunction [4, 5, 8, 9]. Direct toxic effect of the substance on the tissues especially the brain, myocardium and kidney may lead to interference with their normal functions [8].

On the other hand, liver damage occurs when there is the use of halogenated hydrocarbons leading to cirrhosis of the liver and liver failure, whereas aspiration may cause congestion of the lungs with high rates of pneumonia and lung emphysema [9]. Paint sniffers or inhalation of metallic paint results in haemorrhagic alveolitis and the intra-alveolar and lymph node accumulation of particulate laden macrophages, metallic deposition within the upper and lower respiratory tract. Paint sniffing can cause metabolic acidosis, hypocalcaemia, rhabdomyolysis, respiratory depression, and aplastic anemia due to bone marrow depression, and pancytopenia. Most of these effects are usually reversible after stopping of the practice [10].

Causes of death
Solvent abuse is associated with sudden unexpected deaths among the abusers. World Health Organization defines “sudden death” as a death that takes place within 24 hours from the outbreak of the symptoms of the disease [8]. The word sudden is descriptive of the rapidity of death, while unexpected is related to the surprising character of death in describing the discrepancy between the death and the non-existence or mildness of the illness [5]. The cause and mechanism of death in solvent abuse can be due to one of the following factors or a combination of several factors:

(i) Most of the solvents are sensitive to the myocardium due to noradrenaline so any sudden fright releases catecholamine causing ventricular fibrillation and cardiac arrest.
(ii) Acute cardiac failure due to intractable cardiac dysrhythmia may be induced by light plane anesthesia caused by inhaled solvent and potentiated by endogenous catecholamines.
(iii) Vagal stimulation by the freezing gas when sprayed may lead to vagal inhibition which causes reflex cardiac arrest due to stimulation of afferent fibers of the glossopharyngeal nerves, which link to the nucleus of the tenth cranial nerve in the brain stem. Parasympathetic efferent impulses then descend in the vagus nerve and its cardiac branches cause a profound bradycardia, which can amount to total cardiac arrest [11]. Mechanical asphyxia due to the plastic bag containing the solvent especially if the plastic bag is placed over the head and in such cases the abuser will die while the bag is still covering the head and neck.

(iv) Chronic irreversible damage to the liver, kidney and the bone marrow commonly associated with chronic abusers, which may lead to multiple organ failure [11].
(v) Vomiting into air passages which may lead to asphyxiation and suffocation.
(vi) Apart from deaths due to heavy overdose from respiratory centre depression or cardiac dysrythmias, the hallucinogenic effects of such substances can prove fatal.
(vii) Death may be produced by other accompanying events such as drowning, fire, Road Traffic Accident while driving under the influence or crossing the road as a pedestrian because of in coordination and loss of control brought about by the VSA [5].
(viii) Deaths may also be due to poisoning effects of the solvent and suicidal tendencies caused by hallucination and depression have been reported [8, 9].

Toxicology
Toxicological analysis is of paramount importance in the issue of solvent abuse since it is of decisive importance in all volatile substance abuse death related episodes. Due to the large diversity of volatile substances which are abused, the toxicology of VSA is a wide subject to be covered in this paper. The most commonly method used to detect the presence of volatile solvents in biological materials is the Gas chromatography with or without mass spectrometry. The solvent evaporates very fast and it is usually transported to the laboratory in plastic bag tied at the end. Specimens normally taken for diagnosis may include blood, urine or lungs, brain, liver tissues etc. [9-11].

Post-mortem findings and histology
Generally, post-mortem findings depend on the duration of use and are minimal, non-specific, especially when death takes place rapidly and the abuse has been for a short-term. Volatile substance abuse fatalities like all drug abuse deaths represent the most extreme example of toxicity deaths in which the pathologist is more dependent than usual upon the case history circumstances surrounding death, death scene examination, case history presented by the police and the laboratory data provided by the toxicologist.
Most of the findings include:

(i) Grossly the brain is swollen and the cerebral convolutions are flattened. On microscopic level, there is intracellular and perineurial swelling and moderate edema with mild patchy vacuolation of the cerebral tissue and an early perivascular demyelization, cortical neuronal homogenizing anoxic degeneration, chromatolysis, shrinkage, angulation, nuclei pyknosis, elongation, ghost like appearance of neurons and congestion of intracerebral blood vessels and cerebellal degeneration may be seen in chronic volatile abuser [10].

(ii) Lungs findings includes- congestion, pulmonary edema, aspirated material mostly food stuff which fill most of the terminal bronchial tree and the lower respiratory tract, which is normally confirmed with histological examination of the sections to differentiate with post-mortem displacement of digested food to the upper respiratory system. They also include metallic deposition, silica macrophages, hemorrhagic alveolitis which progress to fibrosis [10,12]. Other respiratory findings include chronic inflammation of nasal mucosa, atrophic nasal changes, laryngeal edema, and epiglottitis [8-12].

(iii) Cardiac features are ischemic in nature, including myocardial necrosis and more commonly regional fibrosis due to repeated or continuous hypoxicemic blood supply to the myocardium features also commonly associated with amphetamine abuse [8,13].

(iv) Few pathological findings are also found in the gastrointestinal tract such as sores and excoriation on the lips, gastric erosions and mucosal hemorrhages, vomit and blood in the mouth.

(v) Liver may show cirrhosis with mild to moderate fatty changes while the common renal problems encountered are congestion of the renal parenchyma and swelling of the glomeruli [5,8]. No pathological changes are seen in glue sniffing in vascular system such as angitis, thrombophlebitis, endocarditis, foreign emboli, granulomatosis and foreign body giant cells in contrast to intravenous drug abuse.

Conclusions and recommendations

Currently, many Governments in sub-Saharan Africa view drug control impractical if not rhetoric, as a medium to low priority. This reality does not necessarily suggest neglect on the part of Governments -rather it reflects the extent to which many countries are confronted with a host of unmet resource-intensive needs. This may justify in attaching less than top priority to drug control needs and there is a problem of drug abuse; probably in the next decade which seems to grow to a point of a crisis unless appropriate policy measures are designed.

Glue sniffing is a dangerous practice for the young with acute and chronic serious pathological sequel; thus, every thing should be done to reduce or eliminate its inhalation. This has been partly because; volatile organic solvents are easily available, relatively inexpensive and simple to handle [9]. In order to combat this problem, it is recommended that the public should be educated on the hazards of VSA. The authority should handle this in a calculated and quiet manner that will cause the least panic among the public. The success of such educational programs can be enhanced by drawing up a proper blueprint in consultation with the Ministries of Information, Education, Social services, Health and Research [3,14].

Since glue sniffing has been a common practice, despite the adverse effects, preventive measures should be put in place. The most significant measures may include:

(i) Addition of obnoxious odor substances such as substituting aviation gasoline (avgas) for petrol in the fuel supply: This will cause severe headaches and stomach cramps thus reduce the addiction since the expected effects of euphoria will be replaced with untoward effect [3].

(ii) Restriction of sale of solvents to juveniles; It should be made an offence to “recklessly” sell solvents to children knowing they intend to inhale them [8]. Information campaigning should be started accompanied by employment, skills training programs and other developments that change the economic, cultural and spiritual contents of people’s lives and environment [3,14].

(iii) Public information campaigning; This could help in sensitizing communities on the health impact and rise in petty crime, attributable to glue sniffing. The abuse of indigenous drugs as well as alcohol and tobacco, which have a far greater health impact than other substances, also needs to be understood in greater detail.

(iv) Reduce overcrowding, squatting and poor social services that characterize slums in Africa and particularly in Kenya; - Experience has shown that such areas are breeding grounds for the drug trade and sources. Government should redirect resources to formally recognizing urban slums, allocate expenditure in basic social services and provide legal protection and all measures that should be seen as relieving or pre-emptying drug-related crime.

(v) International support should focus on raising awareness, within urban development institutions and urban renewal programs; The link between urbanization, urban poverty, unemployment and illicit drugs should be brought to lime light.

(vi) Physicians and general practitioners, in particular, should know available techniques of chemical detection of VS, how to deal and advice younger abusers and their families.

(vii) All suspected volatile substance abuse deaths should be reported to the police and full forensic post-mortem investigations done to ascertain the cause of death [3,14].

Therefore it is my view that all these modalities of drug control should have a National multidisciplinary
approach involving epidemiologists, sociologists, policy makers, researchers and medical profession strategy since stand-alone drug control initiatives, except in a few limited cases, should be avoided, as they are unlikely to achieve the economies of scale required to make a difference.

References

Case report of Folie En Famille: a shared psychosis

Ayugi J, Opondo P

Abstract

Shared psychotic disorder (folie a’ deux) is a rare psychiatric syndrome. The main feature of the disorder is transmission of delusion from one person to another especially from one who is apparently more powerful, intelligent, and active (inducer) than another (induced). The objective of the study is to describe a rare psychiatric syndrome of folie en famille in an immigrant African consisting of father, wife and three children living in Botswana. We present a case of a whole family with folie en famille who were admitted to Sbrana Psychiatric Hospital in Botswana following a court order after they locked themselves inside their house for three months. The family consisted of the father, mother and three children. The inducer who was the father was admitted to a different ward from the wife and the children. The inducer, his wife, their children, the social workers, the police, the teachers, friends and neighbours were interviewed at different times over a two week period. All the family members were subjected to psychiatric assessment. Physical examinations were conducted in all the members to rule out possible influencing effects.

The father was the ‘primary’ case and was diagnosed with delusional disorder while the wife and the children were the secondary cases of shared psychosis. The primary (inducer) was the father who suffered from delusional disorder which is transmitted to the whole family and they share the father’s delusions of persecution. The inducer and induced were put on olanzapine 10mg twice a day, start. Treatment was successful in the mother but the response was poor in the inducer. No ant psychosis medicine was administered to the children.

This case highlights the first known reported case of folie en famille in Botswana and possibly most of Southern Africa. Separation of the father who was the ‘primary’ case from the rest of the family; resulted in partial emission of symptoms in the wife and complete remission of delusions from the children.

Key words: Shared psychosis, Folie a’ deux, Folie en famille

Introduction

Folie a’ deux (FAD) or ‘madness shared by two’ or ‘shared psychosis’ is a rare psychiatric syndrome. It was described by Falret and Lasegure in 1877 in France and so sometimes it is called, Lasegure Falret syndrome [1]. However a similar phenomenon to this syndrome was previously described by two other French psychiatrists; Baillager in 1860 who called it “Folie communiquée” (communicated psychosis) and Legrand du Sausle in 1871 who reported a case of “ide de persecution communiquée ou de’ lire al deux a’ trois (communicated persecutory idea or delusions at two and three persons) [2]. The same syndrome shared by more than two people may be called Folie a’ trois, Folie a’ quatre, Folie En Famille or Folie a’ plesieurs or madness of many [3]. According to Legrand du Sausle, the psychiatric symptoms of delusions can be transmitted from one person to another under certain conditions. For example delusions can be transmitted from one who is apparently more powerful, intelligent, and active than another [4]. He or she becomes the inducer. The one who is less intelligent (the recipient) gradually assimilates the delusional ideas, when both live in close association, having common emotions, interests and opinions while living in relative social isolation[4]. A review of literature showed that delusional disorders and schizophrenia were the most commonly diagnosed psychotic disorders in primary dominant persons [5]. Delusions of persecution and grandiose were the most common [5]. In our case the primary person had a delusional disorder.

In the ICD10[6], Folie a’ deux is referred to as induced delusional disorder (F24) and in DSMIV[7] it is referred to as shared psychosis (iv 297.3). Shared psychosis is said to be a rare psychiatric disorder. From 1877 to 2005, there were 242 reported cases and
from 1993 to 2005, there were only 42 cases reported in the literature [8]. Shared psychosis involving the whole family is even rarer and is called folie en famille, though its true population prevalence is difficult to access as the available literature on this condition is scanty and mainly limited to case reports.

Case Report

The inducer: He was a 51 year old male working as an engineer in Botswana, for about two decades, where he lives with his wife and three children (two sons and a daughter). He was referred to Sbrana Psychiatric Hospital through a Court Order accompanied by a police officer, two social workers, his wife and the three children. The basis of the Court Order was that the inducer and members of his family had locked themselves inside their house for three months and refused to open the house door for anybody or answer their cell phones. Only on very rare occasions would one member of family venture out to buy groceries. Concerned neighbours, after several futile attempts to access the family alerted the social welfare department, who after obtaining the Court Order broke down the family house door with help of the police and brought the family to the Psychiatric Hospital.

The inducer was admitted to a different ward from the wife and the children despite the family insistence that they should be discharged or be placed in the same ward or room. The inducer, his wife, their children, the social workers, the police, the teachers, friends and neighbours were interviewed at different times over a two week period. It was established that the inducer was apparently a very hard working and successful engineer who often won Government contracts. However for the last year or so he had not been awarded any contracts and the money due for previous contracts had been delayed. Since then, he had been noticed to be gradually isolating himself from friends and neighbours and avoiding going to church and for the last three months had locked himself and his family inside their house. The inducer on interview was unkempt, calm but suspicious, orientated, and laughed at the suggestion that he could be having a mental problem. He only agreed to be interviewed after reassurance that the suggestion that he could be having a mental problem.

The wife: The induced was the wife, who was a 43 year old mother of three. She had been a junior lecturer at a local College but had lost her job because of poor performance the previous year. When interviewed she believed that everybody had turned against their family; including neighbours, church mates, friends and relatives. Her neighbours no longer talked to her or her family, friends did not visit them anymore and the shopkeeper put charms into their groceries to harm them. But she believed in God for protection. The police and immigration were harassing them though their visa was valid for another three years. Their children were discriminated against in school and isolated; and their teachers did nothing to help them. Hence she and her husband had decided to withdraw the children from their school. They had also decided as a family to stay indoors as everybody was against them. She agreed with her husband that the government was using all institutions to harm and persecute them; but God was on their side. She denied misuse of drugs and a drug screen was normal. There was no family history of mental illness. Overall she appeared to be histrionic and submissive. She was diagnosed with induced psychosis and started on olanzapine 10mg twice a day, which was progressively increased to a maximum dose for his weight in a period of two months.

The children: The elder son was 15 years old, his brother 12 years and their sister 9 years. They were all articulate, confident and repeated the beliefs of their parents that the family was being harassed, and hated by everybody. They narrated how they were tortured in school by their peers and teachers. The ‘torture’ consisted of being bullied, their books being stolen, their desks moved and other children talking behind their backs in their strange language (the local Setswana dialect). All the time, their teachers did nothing to protect or help them. When their uncle came to visit them after hearing about their admission, they queried the timing of the

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visit as it coincided with them being admitted after all their tribulations. They asked themselves why now? The youngest of the children called the uncle ‘a foreign agent’. ‘We don’t even know him!’ They agreed with their parents that it was good to withdraw them from school. They denied that they were abused physically or verbally by their parents and were unanimous that their parents were good to them. The children were generally suspicious, mistrustful and before any interview session, always consulted their mother alone for a few minutes. Prior to their admission, it was established that the children had been social and mixed well with friends in school and the neighborhood. But gradually they had become withdrawn, mistrustful and started missing classes. Their grades also deteriorated over several weeks from A’s to C’s. They were diagnosed with shared psychoses. They spent about a week in hospital (as ‘lodgers’) as social workers needed to find a safe house for them away from their parents. This was achieved after about a week and they stayed in a safe house for the remainder of their parents’ admission, without medications.

Results

The inducer: After being on antipsychotics for about two months in hospital, he showed little change. His persecutory delusions were largely intact. After intensive psychotherapy within the same period, he agreed that his children could go back to school, and he would continue his medications on discharge. The blood pressure had stabilized on no medications.

The wife: Though she continued to believe that the family was being harassed and persecuted, these beliefs were not as firmly held as at admission. She was agreeable for the children to go back to school and continue her medications on discharge.

The children: After staying in the safe house for the duration of their parents’ admission, the children showed remarkable recovery. They were well groomed, more articulate and confident than before. They had no delusions and showed eagerness at going back to school.

Discussion

The bulk of knowledge regarding Folie a’ deux, consists of case reports. The diagnosis is made on the basis of certain established criteria in ICD 10 or DSM IV. These criteria include (a) delusion developing in a person who is in close association with another one person who already has an established delusion. (b) the delusions are similar and (c) the disturbance is not accounted for by another psychotic disorder or physiological effects of substance or any other general medical condition. In this case, after obtaining histories from those concerned and conducting mental state examinations, we made a diagnosis of Folie en Famille. In our case, there was a close intimate association between the inducer (the husband) and the recipients (wife and children). This is one of the conditions of Lazarus[9]. The inducer (the father) suffered from a delusional disorder and imposed his delusions on the more submissive wife and children. The inducer often possesses certain characteristics that place him or her in a position of dominance. He was a highly educated individual (an engineer) with considerable means by community standards, older than others in the family, with a forceful character; unlike the wife who was more submissive and less educated, or the children who were not only much younger but completely dependent on their father. This family had isolated themselves from their neighbours and friends and locked themselves in their house for about three months. They bought food and other provisions in bulk and only ventured out briefly to replenish food. This prolonged family isolation, further augmented the transfer of the delusions. The wife’s submissiveness and intimate close association with the dominant husband while completely isolated from the outside world for months facilitated the transfer of the husband’s delusions to the wife and the dependent children. Though social isolation has been described as a major risk factor for the development of folie a’ deux, other factors for example, passive personality, histrionic personality, cognitive impairment, language difficulties and life events may play an important part in the development of this syndrome[5,10]. The acceptance of the delusion by the wife and the children indeed reduced their risk of losing the inducer’s intimate relationship and other resources. Hence the overall environment that this family lived in for about three months made them hostile, mistrustful and paranoid to the rest of their neighbours, friends, relatives and indeed the rest of the community.

In most of the available literature, separation of the inducer from the recipients is said to be crucial in the overall management of the condition [10]. In our case this was a big challenge and was possible only with help of the social welfare department who managed to identify a safe house for the children. Following two months of separation from the inducer (the father), the children showed no delusions but the wife still had residual persecutory ideations, while the inducer was still deluded though agreeing to comply with medications, socialize to a certain extent with other persons and let the children go back to school. Hence separation may not always lead to immediate or permanent resolution of symptoms [11].

The children: The children, prior to their isolation in their house had been removed from school by the father on the grounds that the teachers and other students were against them. The children accepted this situation, because they believed that they were being ‘tortured’ in school by their peers who ‘stole their books, desks and always talked behind their backs in a language they did not understand’. The fact that they were foreigners (non- Batswana) and could not fully understand the local language further fuelled their mistrust of their peers, despite the fact that the school had a large pool of other foreign children. When the children told their parents of their ‘torture ’ in school, their father confirmed to them that this was part of a general conspiracy by government and its institutions, including their school management,
to harm them, frustrate them and deport them from that country. Hence the children could have initially struggled with their loyalties to two divergent belief systems in school and at home. Eventually they succumbed to the delusional home system. This psychological struggle can easily result in overt symptomatology and poor functioning. The children were found to be suspicious, mistrust full and paranoid. When they met their uncle whom they had never met, the youngest child believed that he was a ‘foreign agent’ and part of the government people out to harm them as a family.

Family attempt to maintain cohesiveness: Both these parents were paranoid and suspicious. It was observed that before every interview with the children, the mother would first talk to the children alone. After such talks from their mother, the children would talk with one voice and repeat similar stories like their mother and father of being punished, tortured and bullied in school. Interview with their teachers did not confirm these torture stories. Both parents were both paranoid and demanded secrecy and loyalty from their children. The children could not challenge their parents’ false beliefs, possibly because of fear, and need to avoid parental anger, retaliation and abandonment. Because of the parental delusions, the children were removed from school, confined to their home and denied contact with peers. In this kind of scenario, the children may be at risk of physical danger. In our case the children abandoned to comb their hair or wash for days unless they were getting out of the house briefly when they would only ‘refresh’. In our case, after being separated from the parents for about two months they showed no previous delusions or other psychotic symptomatology. Progression of delusional symptoms to a Folie en famille is thought to reflect a dramatic attempt of a family to maintain cohesiveness in the presence of a perceived hostile environment [12]. Sharing these delusions is said to contribute to the development of a ‘pseudo community’[13].

Conclusion

Separation of the mother and the children from the father resulted in partial remission of the mother’s delusions and complete symptom relief of the children and hence should still be the standard form of therapy for this condition, even in challenging circumstances like ours. But other innovative interventions should be considered including; psychotherapy, contributions by welfare agencies, and involvement of school authorities. After discharge it is paramount to follow these rare cases up, as we intend to do for several months to monitor prognosis and general out comes.

References

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Case Report

Non-surgical management of perforated appendix in pregnancy: a case report

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Abstract

Perforation of the appendix in pregnancy is a rare and serious complication that is associated with significant maternal and fetal morbidity. We present a pregnant patient with perforated appendix at 30 weeks gestation who was treated non-surgically with intravenous antibiotics, bowel rest and intravenous fluids with a favourable outcome. Non-surgical management of a perforated appendix in pregnancy may be a treatment option as shown by this case.

Key words: Non-surgical management, Perforated appendix, Pregnancy.

Introduction

Acute appendicitis is the most common non-obstetric surgical emergency in pregnancy[1]. Diagnosis may be difficult and delayed by early symptoms of pregnancy, displacement of the appendix and upward shift of the abdominal wall by the gravid uterus, abdominal wall laxity, round ligament spasm and physiological leucocytosis of pregnancy[2]. Studies have reported the usual diagnostics of acute appendicitis by signs, symptoms and laboratory results in the non-pregnant state to be unreliable in pregnancy [3]. When uncomplicated appendicitis is suspected in pregnant patients, prompt surgical treatment is recommended to avoid perforation and its subsequent complications[4]. Studies in the non-obstetric population support medical treatment of perforated appendix to avoid surgical morbidity[5,6]. However, the best treatment for pregnant patients with perforated appendix has not been determined.

We present a pregnant patient with perforated appendix at 30 weeks gestation who was treated non-surgically with intravenous fluids, antibiotics and bowel rest with a favourable outcome. Non-surgical management of perforated appendix in pregnancy may be a treatment option as shown by this case.

Case Report

A 34 year old Gravida 4 Para 3+0 presented at 30 weeks gestation with fever, generalized abdominal discomfort and pains of four days duration. On physical examination, the fundal height corresponded with a gestational age of thirty-two weeks gestation. There was generalized abdominal pain with rebound tenderness on palpation. The bowel sounds were scanty on auscultation. Abdomino-pelvic ultrasound examination revealed marked free fluid in the peritoneal cavity suggestive of perforation or haemoperitoneum. Appendiceal collection, inflammation plus peritoneal fluid with a variable cyesis at 30.3 weeks gestation was made. A consultation for review was sent to the surgeons who reviewed the case and advised medical management of the patient as would be recommended in the non-pregnant patient. The medical management consisted of the passing of a naso-gastric tube, nil by mouth until further notice, intravenous dextrose-saline infusion alternating with full strength darrows solution, urinary bladder catheterization with instructions to monitor the fluid input and output. Intravenous ceftriaxone 1 gram to be given 12hourly and intravenous metronidazole 500mg 8hourly were prescribed for seven days. Intravenous pentazocine was given 8hourly for 72 hours. Her condition remained stable on the above medical regimen and spontaneous labour ensued after two days in the ward. A live, female baby with Apgar score 6 at 1minute and 9 at 10 minutes who weighed 1.3kg was delivered and admitted into the neonatal unit. The patient had an uncomplicated postpartum period and was discharged after 16 days.
Discussion

The natural history of appendicitis is a progression from simple appendicitis to perforation with subsequent complications including peritonitis, sepsis and abscess formation[7]. The incidence of perforated appendix is higher in pregnancy at 43% compared to 4 to 19% in the non-pregnant population[1].

Studies in the non-pregnant population demonstrate the morbidity of surgical management of a perforated appendix and favourable outcomes with non-surgical management[5]. There is a paucity of literature regarding non-surgical management of perforated appendix in the obstetric population.

Perforation of the appendix in pregnancy is a serious complication with an associated maternal and fetal mortality of 17% and 43% respectively[8]. A study over a 13 year period demonstrated a 17% fetal mortality rate in all appendicectomies in pregnancy. Out of these, 60% had a perforated appendix[9]. Preterm labour and delivery is common in women with perforated appendix due to the intra-abdominal inflammatory response as the case in point. It is thought that infection stimulates inflammatory mediators and subsequently increases prostaglandin production that can cause contractions and cervical change[10].

Medical management of perforated appendix is associated with higher success rates and lower rates of complications compared with operative management[5]. Non-operative management of perforated appendix includes bowel rest, intravenous antibiotics and fluids as was implemented for our patient.

In the meta-analysis of non-surgical treatment of appendicular abscess by Anderson and Petzgold, [5] patients undergoing immediate surgery for a ruptured appendix had a statistically significant increased rate of infectious complications, intestinal fistulae and small bowel obstruction compared with patients managed non-operatively. Intense tissue inflammation from a perforated appendix may lead to a right-sided hemicolectomy or difficulties closing the appendiceal stump during appendicectomy. Appendicitis in pregnancy is a difficult diagnosis and emphasis must be placed on clinical judgment to allow an appropriate and timely intervention. Delay in surgical intervention as seen in our patient who was symptomatic for four days prior to presentation would lead to perforation. Patients with perforations of the appendix would often have been symptomatic for 24 or more hours[9].

In conclusion, our experience in this case and that of others cited in the literature suggest that non-surgical management of perforated appendix in pregnancy is possible with a favourable outcome.

References

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1) Clinical Department
2) Teaching and Research Department

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- A projected Bed Capacity of 600 plus
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- Neuroscience and Spinal unit,
- Geriatrics
- Gender Violence and recovery centre.
- Organ transplant unit
- Telemedicine facilities

Hospital Departments
Twelve teaching departments have been established
Clinical departments will include;
- General Diagnostic
- Laboratory
- Radiology & Imaging
- Accident & Emergency
- Minor Theatres

Personnel, Equipment and Capacity Building
- Direct hiring
- Expert exchange program through collaboration with major centers of excellence and hospitals both locally and internationally this include those seconded from government of Kenya Hospitals
- Current Personnel will be trained on medium and long term basis to bridge identified gaps
- Modern state of the art equipment have been identified for the hospital
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Paediatric Hospital
- Proposal at advanced stage
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