Candida vaginitis among symptomatic pregnant women attending antenatal clinics in Mwanza, Tanzania

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Abstract
Objective: This study was done to determine the patterns of Candida spp. causing vaginitis and associated factors among pregnant women attending antenatal clinic in Mwanza, Tanzania.

Results: A total of 197 (65.6%) out of 300 non-repetitive swabs had positive growth of Candida spp. Candida albicans 125 (63.4%) was the most predominant isolated specie followed by C. tropicalis 35 (17.8%) and C. glabrata 33 (16.8%). Laboratory confirmed candida vaginitis was independently predicted by douching practices (OR 3.2, 95% CI 1.3–7.5 P = 0.007), history of antibiotics use (OR 1.8, 95% CI 1.02–3.0, P = 0.04) and low social economic status (OR 2.04, 95% CI 1.1–3.7 P = 0.02). About two-third of pregnant women with clinical features of vaginitis attending antenatal clinic in Mwanza, Tanzania were confirmed to have Candida vaginitis mainly caused by Candida albicans.

Keywords: Candida vaginitis, Candida albicans, Douching, Antibiotic use, Low social economic status

Introduction
Vulvo vaginal candidiasis or Candida vaginitis is the fungal infection of the female lower genital tract (vagina and vulva) caused by Candida spp. [1]. Candida vaginitis is the second most complain among women attending obstetrics and gynecological clinics worldwide [2, 3]. It is estimated that about 75% of women are affected with Candida vaginitis at least once during their life time with 15% of these cases present with a “cyclic recurrent type” which is defined as four or more episodes of Candida vaginitis in a year [4, 5].

Studies have shown that Candida albicans accounts for 80–95% of all episodes of candida vaginitis worldwide [4, 6]. However, there is an increase of cases due to non-Candida albicans species led by Candida glabrata [7]. Other non-Candida albicans species reported to be associated with Candida vaginitis include: Candida tropicalis, Candida parapsilosis, Candida lusitaniae, Candida famata, Candida kefyr, Candida sake, Candida inconspicua, Candida valida, Candida colliculosa, Candida utilis, Candida catenulata, Candida lipolytica, Candida membranaefaciens, Candida intermedia and Candida globosa [7–9].

In East Africa, a study done in Aghakhan hospital-Kenya reported C. albicans as the prominent species with prevalence of 69.3% followed by C. glabrata 12.9% [10]. In Tanzania, non-Candida albicans species were reported to contribute about 37% of Candida vaginitis cases [11]. However, data on azole susceptibility patterns and factors associated with Candida vaginitis are still limited. Here, we report the prevalence and factors associated with laboratory confirmed Candida vaginitis among pregnant women with symptoms of vaginitis attending antenatal clinics in Mwanza, Tanzania. Furthermore, data on the azole susceptibility patterns of these Candida spp. are reported.

Main text
This was a cross section study conducted from February to July 2016. The study was conducted at antenatal clinics of Nyamagana district hospital and Makongoro reproductive and child health clinic in Mwanza, Northwestern Tanzania. The selected clinics are representative...
of antenatal clinics that are highly populated in Mwanza serving more than 100 pregnant women per day.

Fungal isolation and fungal speciation by chromogenic agar were carried in the CUHAS microbiology laboratory and specie confirmation and antifungal susceptibility testing was done at Institute of Medical Microbiology, Göttingen, Germany.

All pregnant mothers attending antenatal clinics suspected of having Candida vaginitis and consented were recruited serially until the sample size was reached. For this study clinical Candida vaginitis was defined as having two or more of the following symptoms vaginal pruritus (itching), a thick odorless cottage cheese-like discharge and soreness [1]. The minimum sample size was obtained by the use of Kish Leslie formula [4].

Culture for isolation and identifications of Candida spp.
High vaginal swabs were cultured on Sabouraud’s dextrose agar (SDA) supplemented with 50 µg/ml gentamicin and 50 µg/ml chloramphenicol (HiMedia-Mumbai, India) as previously described [12]. All yeasts isolated were identified to species level using chromogenic agar. Furthermore, 98 randomly picked isolates were confirmed by the use of matrix-assisted laser desorption ionization-time of flight (MALDI-TOF) mass spectrometry [Bruker Daltonics, Bremen, Germany] on extracted cells harvested from SDA as previous described [12, 13].

In vitro susceptibility assays
Antifungal susceptibility testing was done by establishing minimum inhibitory concentration (MIC) of fluconazole, voriconazole, posaconazole (Discovery Fine Chemicals, Bournemouth, United Kingdom), micafungin (Roht, Germany), caspofungin (Merck, US), and 5-fluorocytosine (Sigma Aldrich, US) following the guidelines laid down by the EUCAST [13].

Data analysis and management
All data collected were entered into Microsoft excel sheet for cleaning and coding then transferred to STATA version 13 for analysis according to the objectives of the study. Data were summarized into percentage for categorical variables while continuous variables (age and gestation age) were summarized as median with interquartile range (IQR). Logistic regression analysis was done to determine predictors of candida vaginitis. Statistical significant was considered when P value was less than 0.05 with 95% confidence interval.

Ethical considerations
The protocol to conduct this study was approved by the joint Catholic University of Health and Allied Sciences/Bugando Medical Centre research ethics and review committee (CREC) with certificate number CREC/045/2014. Permission to conduct the study was sought from all hospital administrations. All patients were requested to sign the written informed consent before recruitment and patients’ data were treated as confidential.

Results
A total of 300 pregnant women with mean age of 27±6.2 years were recruited. The majority of women were married 275 (91.7%), resided in urban areas 262 (87.3%) and had primary school education 201 (67%). About half of studied participants 168 (56%) booked their first antenatal clinic on third trimester while 106 (35.3%) and 26 (8.7%) booked on second and first trimester, respectively. Their median gestation age at recruitment was 28 with interquartile range of 20–32 weeks. Most of the pregnant women had low social economic status 221 (74%) as defined by having a fridge and television.

Laboratory confirmed Candida vaginitis was detected in 65.7% (197/300) of symptomatic pregnant women. Candida albicans was the most predominant detected Candida spp. 125 (63.4%). A total of 72 (24%) patients were diagnosed to have Candida vaginitis caused by non-Candida albicans spp. The predominant non Candida albicans spp. detected was Candida tropicalis 35 (17.8%), Fig. 1. All isolated Candida albicans were highly susceptible to azole antifungal agents. However, Candida krusei were highly resistant to fluconazole and susceptible to other azole agents, Additional file 1.

Factors associated with Candida vaginitis among pregnant women
On univariable analysis, increase in gestation age OR 1.03, 95% CI 1.01–1.06, P = 0.04, not having a secondary school education OR 2, 95% CI 1.3–3.3, P = 0.008, practicing douching OR 2.8, 95% CI 1.28–6.25, P = 0.01, history of antibiotic use in the past 2 weeks OR 1.8, 95% CI 1.15–3.03, P = 0.011 and low social economic status OR 2.03, 95% CI 1.21–3.42, P = 0.008 were found to be associated with laboratory confirmed Candida vaginitis, Table 1.

On multivariable logistic regression analysis, having douching practices OR 3.2, 95% CI 1.4–7.5, P = 0.007, history of antibiotic use in the past 2 weeks OR 1.8, 95% CI 1.02–3.0, P = 0.02 and low social economic status OR 2.04, 95% CI 1.1–3.7, P = 0.02 were independent predictors of laboratory confirmed Candida vaginitis, Table 1.

Discussion
Candida vaginitis or thrush is the vaginal infection caused by yeast cells and commonly being reported among pregnant women of 20–40 years of age [2]. This has also been
observed in the current study were by the median age of
the pregnant women with clinical Candida vaginitis was
28 with interquartile range of 22–32 years. Physiological
and tissue changes, due to reproductive hormones, which
happen in young women especially during pregnancy,
increase their susceptibility to Candida infection, in addi-
tion to adverse factors such as risky sexual behaviors.
Previous study conducted in North America suggested
that 70–75% of women can get at least one episode of
Candida vaginitis in life time [6].

The current study established the prevalence of labo-
ratory Candida vaginitis to be 65.7% among symp-
tomatic pregnant women. This finding is similar to
previous report from Nigeria which reported the preva-
ence of 62.2% [4] and slightly higher than 55.4% that
was reported in Cameroon [14]. The different in study
population could explain the differences. The study in
Cameroon involved health non-pregnant women while
the current study and the one from Nigeria involved
pregnant women. The changes in sex hormones during
pregnancy has been highly associated with the increases
chances of Candida vaginitis [3].

As previous reported from different studies [2, 3, 11],
the current study found C. albicans to be the most pre-
dominant specie causing Candida vaginitis. The virulence
nature of Candida albicans in comparison to other Can-
dida spp. could explain the findings [13]. Furthermore,
Candida albicans has been reported to be the most com-
mon Candida spp. colonizing the vaginal mucosa giving
it high chance of causing infections in case of the pres-
ence of favorable conditions [10].

The use of antibiotic is known to suppress the bacte-
rrial normal flora and allow the overgrowth of yeast cells
hence causing Candida vaginitis [15]. This was proven in
the current study whereby the use of antibiotic was found
to be an independent predictor of laboratory confirmed
Candida vaginitis. Additionally in the current study
douching practices which is also known to impair the
growth of the vaginal microbiota [16–18] was found to
independently predict the laboratory confirmed Candida
vaginitis.

In the current study having low social economic status
was also found to predict laboratory confirmed Candida
vaginitis. Low social economic status is associated with
poor hygiene [19]. Inability of the women to access basic
needs include clean water and health care affect their
hygienic practices. The poor hygienic practices can easily
lead to vaginal candidiasis as previous observed in Cam-
eroon [3].

About two-third of pregnant women with clinical fea-
tures of vaginitis attending antenatal clinic in Mwanza,
Tanzania were laboratory confirmed to have Candida
vaginitis mainly caused by Candida albicans. Pregnant
women with low social economic status (SES) with

![Fig. 1 Distributions of Candida spp. detected to cause Candida vaginitis](image-url)
history of antibiotic use and who are practicing douching are more likely to suffer Candida vaginitis. A large cohort study among the high risk groups is recommended to determine the effect of the vaginal candidiasis to the pregnancy.

| Variable          | Culture positive (%) | Culture negative (%) | Univariate OR (95% CI) | P value | Multivariate OR (95% CI) | P value |
|-------------------|----------------------|----------------------|------------------------|---------|--------------------------|---------|
| Age               | 28 [22–32]           | 26 [22–30]           | 1.03 (1.0–1.07)        | 0.119   | 1.01 (0.9–1.1)           | 0.528   |
| Gestation age     | 28 [20–32]           | 24 [20–32]           | 1.03 (1.01–1.06)       | 0.041   | 1.03 (0.9–1.1)           | 0.068   |
| Residence         |                      |                      |                        |         |                          |         |
| Urban (262)       | 167 (63.7)           | 95 (36.3)            | 1.03 (0.9–1.1)         | 0.057   | 1.01 (0.9–1.1)           | 0.068   |
| Rural (38)        | 30 (78.9)            | 8 (21.1)             | 0.46 (0.21–1.06)       | 0.070   | –                        | –       |
| Marital status    |                      |                      |                        |         |                          |         |
| Single (25)       | 14 (56.0)            | 11 (44.0)            | –                      | –       | –                        | –       |
| Married (275)     | 183 (66.6)           | 92 (33.4)            | 1.56 (0.68–3.58)       | 0.291   | –                        | –       |
| Education         |                      |                      |                        |         |                          |         |
| Primary (201)     | 141 (70.1)           | 60 (29.9)            | 1.03 (0.9–1.1)         | 0.068   | 1.02 (0.9–1.1)           | 0.280   |
| Secondary (89)    | 48 (53.9)            | 41 (61.6)            | 2 (1.3–3.3)            | 0.008   | 1.25 (0.8–2.5)           | 0.411   |
| College (10)      | 8 (80.0)             | 2 (20)               | 1.7 (0.4–8.3)          | 0.059   | 3.5 (0.6–18.9)           | 0.150   |
| Occupation        |                      |                      |                        |         |                          |         |
| Employed (184)    | 114 (67.0)           | 70 (38.0)            | 1.54 (0.93–2.54)       | 0.089   | –                        | –       |
| Unemployed (116)  | 83 (71.6)            | 33 (28.3)            | 1.58 (1.15–2.15)       | 0.020   | –                        | –       |
| Yoghurt drinking  |                      |                      |                        |         |                          |         |
| Yes (119)         | 72 (60.5)            | 47 (39.5)            | 1.54 (0.93–2.54)       | 0.089   | –                        | –       |
| No (181)          | 125 (69.1)           | 56 (30.9)            | 1.46 (0.89–2.36)       | 0.128   | –                        | –       |
| Drinking alcohol  |                      |                      |                        |         |                          |         |
| No (255)          | 166 (65.1)           | 89 (34.9)            | 1.56 (0.9–2.8)         | 0.133   | –                        | –       |
| Yes (45)          | 31 (68.9)            | 14 (31.1)            | 1.18 (0.6–2.3)         | 0.622   | –                        | –       |
| Gravidity         |                      |                      |                        |         |                          |         |
| Prime gravid (73) | 43 (58.9)            | 30 (41.1)            | 1.56 (0.9–2.8)         | 0.133   | –                        | –       |
| Gravid two (78)   | 51 (65.4)            | 27 (34.6)            | 1.56 (0.9–2.8)         | 0.133   | –                        | –       |
| Multi gravid (149)| 103 (69.1)           | 46 (38.9)            | 1.56 (0.9–2.8)         | 0.133   | –                        | –       |
| Douching          |                      |                      |                        |         |                          |         |
| No (28)           | 12 (42.9)            | 16 (57.1)            | 1.56 (0.9–2.8)         | 0.133   | –                        | –       |
| Yes (272)         | 185 (68.0)           | 87 (32.0)            | 1.56 (0.9–2.8)         | 0.133   | –                        | –       |
| STI results*      |                      |                      |                        |         |                          |         |
| Negative (233)    | 159 (68.2)           | 74 (31.8)            | 1.56 (0.9–2.8)         | 0.133   | –                        | –       |
| Positive (10)     | 3 (30)               | 7 (70)               | 1.56 (0.9–2.8)         | 0.133   | –                        | –       |
| Antibiotic use    |                      |                      |                        |         |                          |         |
| No (147)          | 86 (58.5)            | 61 (41.5)            | 1.56 (0.9–2.8)         | 0.133   | –                        | –       |
| Yes (153)         | 111 (72.6)           | 42 (27.4)            | 1.56 (0.9–2.8)         | 0.133   | –                        | –       |
| HIV               |                      |                      |                        |         |                          |         |
| Negative (290)    | 189 (65.2)           | 101 (34.8)           | 1.56 (0.9–2.8)         | 0.133   | –                        | –       |
| Positive (10)     | 8 (80.00)            | 2 (20.0)             | 1.56 (0.9–2.8)         | 0.133   | –                        | –       |
| SES               |                      |                      |                        |         |                          |         |
| High (82)         | 44 (53.7)            | 38 (46.3)            | 1.56 (0.9–2.8)         | 0.133   | –                        | –       |
| Low (218)         | 153 (70.2)           | 65 (29.8)            | 1.56 (0.9–2.8)         | 0.133   | –                        | –       |

The box bracket [ ] is inter quartile range for gestation age while the curved brackets () is percentage

*Only 243 women tested for VDRL

SES Social economic status
Limitation
The prevalence of laboratory Candida vaginitis in the current might be under estimated because the features used are not specific for Candida vaginitis.

Supplementary information
Supplementary information accompanies this paper at https://doi.org/10.1186/s13104-019-4793-z.

Additional file 1: Table S1. Antifungal susceptibility test data.

Abbreviations
BMC: Bugando Medical Centre; CUHAS: Catholic University of Health and Allied Sciences; EUCAST: European Committee of Antimicrobial Susceptibility Testing; OR: odd ratio; MALDI-TOF: Matrix-assisted Laser Desorption Ionization-Time of Flight; SDA: Sabouraud’s dextrose agar.

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Authors’ contributions
MFM and SEM designed the work. AM & MFM recruited patients, performed laboratory investigations and results interpretations. MFM and SEM analyzed and interpreted the data. MFM wrote the first draft of the manuscript which was critically reviewed by SEM. All authors read and approved the final manuscript.

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Availability of data and materials
The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Ethics approval and consent to participate
The protocol to conduct this study was approved by the joint CUHAS/BMC research ethics. All patients were requested to sign the written informed consent before recruitment was done. All patients’ data were treated as confidential.

Consent for publication
None applicable.

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

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