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Bacteriological Quality of River Oroghodo

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ABSTRACT: The water quality of river Oroghodo was assessed during bacteriological parameters, which were determined using standard plate count and multiple tube techniques. Analysis revealed that total heterotrophic bacteria and potential human pathogenic bacteria counts were 5.55×10^3- 55.65×10^3 cfu/ml and 4.35×10^3 – 55.30×10^3 cfu/ml respectively. Total coliform, *E. coli Enterococcus faecalis* and *Clostridum perfringens* counts ranged from 55 – 900 MPN/100ml, 13 – 388 MPN/100ml, 50 – 240 MPN/100m and 14 – 215 MPN/100ml respectively. Other bacteria isolated were *Pseudomonas* species, *Klebsiella prenumoniae* and *Enterococcus* species. The number and kinds of enteric organisms encountered suggest a possible faecal contamination with possible consequent undesirable public health implications.

Key Words: Water quality; River Oroghodo; Bacteria counts; Pathogenic bacteria; Faecal contamination.

Introduction

Information and data obtained from Edo State Department of Lands and Surveys show that river Oroghodo lies between Latitude 6° 02’ and 6° 15’ East of Greenwich. It has its source in Oliegie in Uhunmwode Local Government Area of Edo State and joins the river Ethiope at Urhuoka near Abraka In delta State.

River Oroghodo is the main source of water supply to Ugo, Evboesi and Urhehue communities in O-jionwon Local Government Area of Edo State especially during the dry season. This is a common phenomenon in rural Nigeria and many rural communities in the developing countries of the world where the inhabitants depend solely on untreated natural (river) water for use (Thurman *et al*., 1998). Information and data from the office of National population commission, Benin City reveals that Ugo, Evboesi and Urhehue have a total population of 13,360 as at 1991 and with a growth date of 2% per annum, this will approximate 15,966 by 2000 AD. Although there are no records from the Ministry of Health showing out breaks of water – borne or water related enteric diseases in these communities, indigenes of the area claim that there have been out breaks of diarrhoea, dysentery and enteric fever which they suspect to be due to consumption of poor quality water from the river Water borne diseases associated with drinking of poor quality water are responsible for about 10 – 25 million deaths per year, out of which 60% are children (Fjendo-Jordensen *et al*., 1998). Ogan and Nwiika (1993), examined the lower Niger delta water and declared that faecal bacteria densities are exceedingly high in fresh water systems in rural area of tropical regions where water are usually untreated and run – off water contaminates river and wells. In river

Ethiope into which river Oroghodo empties its water, Amoforitse (1996) found the total heterotrophic bacteria and human parasitic bacteria counts to be 5.0 – 11.0 x 10^4 cfu/ml and 3.0 – 9.0 x 10^4 cfu/ml respectively. His other findings include coliform counts of 0.6 – 5.3 x 10^4 MPN/100ml and *E. coli* counts of 0.02 – 2.86 x 10^4 MPN/100ml, *Enterococcus faecalis*, 8m – 360MPN/100ml and *Clostridium perfringens*, 4 – 80 MPN/100ml. This study is designed to determine the bacteriological quality of river Oroghodo at a point where it serves Ugo, Evboesi and Urhehue communities, with a view to unveiling the sources of gastrointestinal tract infections in these communities.

Materials and Methods

Collection of Samples

Water samples for bacteriological analysis were collected directly from the river with the aid of pre-sterilized 200ml glass bottles with glass stoppers. The bottles were held in an upstream position relative to the collector and dipped into the water with the base perpendicular to the flow direction. They were opened under water at about 30cm depth, allowed to fill up, closed under water and quickly transferred into an ice chest for transport to the laboratory where bacteriological analyses were performed within two hours of sample collection. Samples were collected fortnightly from November 1998 to February 1999 and then in May and June 1999.

Bacteriological analyses

Total viable aerobic bacteria were enumerated by means of the pour plate technique by inoculating 1ml aliquots of serially diluted water samples on plates of plate count agar. Duplicate plates were prepared. One set was incubated at 28 ± 2°C to determine total heterotrophic bacteria and the other at 37°C to detect potential human pathogenic bacteria. Distinct colonies were stored on Nutrient agar slants at 4°C for further characterization and identification using conventional morphological and biochemical tests (Cowan, 1985).

Total coliform and *E. coli* counts were determined by the most probable number technique using lactose broth tubes. Subcultures were made from all *E. coli* positive tubes onto Eosin methylene blue (EMB) and MacConkey agar plates and incubated at 37°C for 24 hours. Characteristic and typical colonies with greenish metallic sheen on EMB agar were transferred onto nutrient agar slants for further characterization and identification. The most probable number technique also was used for the determination of *Enterococcus faecalis* using Azide – glucose broth (Hannay and Norton, 1947), as well as *Clostridum perfringens* using differential reinforced *Clostridum* medium (DRCM). Subcultures from Azide glucose broth were made onto plates of MacConkey agar and characteristic colonies of *Enterococcus faecalis* identified by conventional morphological and biochemical tests. Subcultures from positive differential clostridium medium tubes were made onto plates of (DRCM) agar and distinctive colonies identified by morphological and biochemical tests.

1ml aliquots of the undiluted water samples were spread on dried deoxycholate citrate agar (DCA) plates and incubated at 37°C for 48 hours with a view to isolating other possible enteric bacterial pathogens. Typical colonies were selected for purity plating and further identification tests. These were then identified on the basis of cultural characteristics morphology, Gram staining reaction, and biochemical reactions (Cowan, 1985).

Results and Discussion

The total hecterotrophic bacteria counts and potential human pathogenic bacteria counts for river Oroghodo are shown in Fig. 1. As the dry season progressed, total bacteria counts decreased. This decrease may be attributed to sedimentation, reduction in available nutrients and die off of organisms (Kay and McDonald, 1980; Wyer *et al*., 1995).

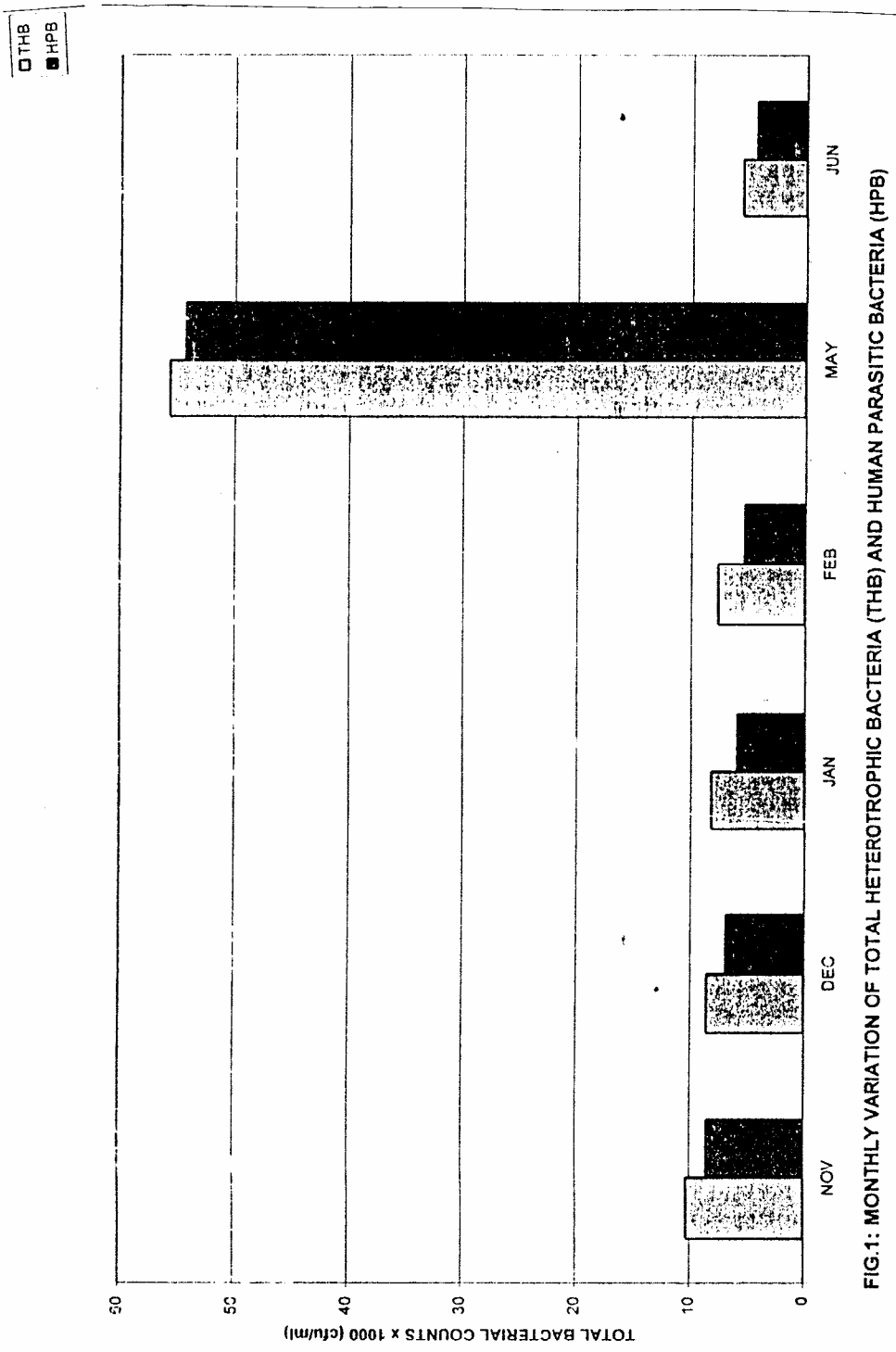
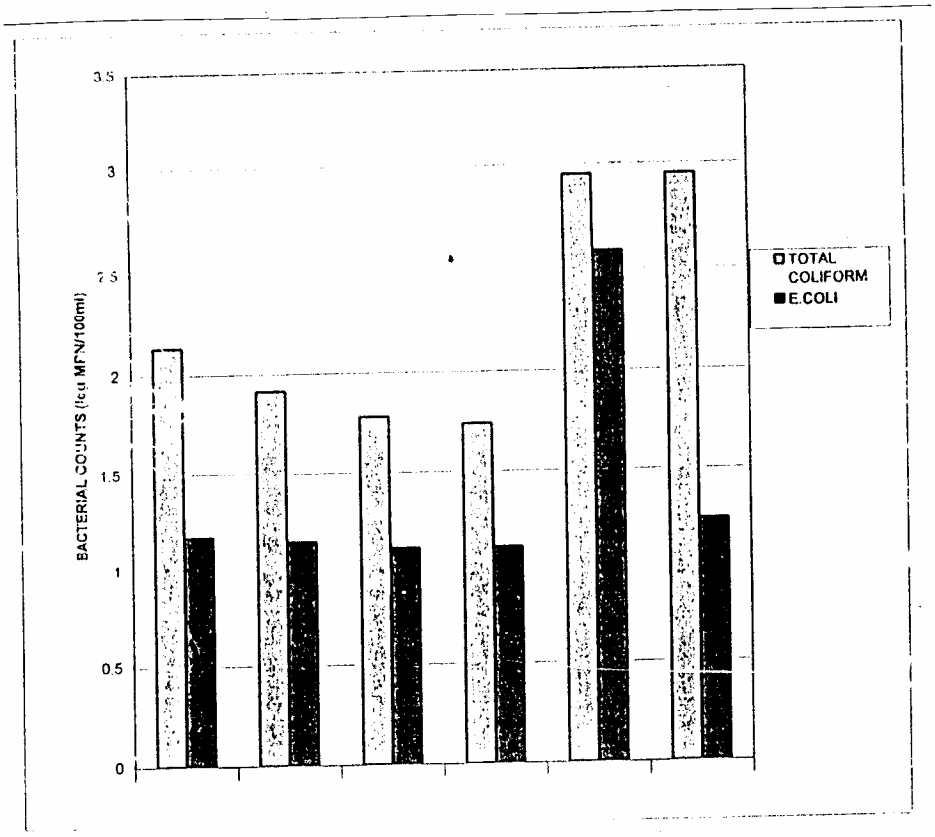


FIG.1: MONTHLY VARIATION OF TOTAL HETEROTROPHIC BACTERIA (THB) AND HUMAN PARASITIC BACTERIA (HPB)



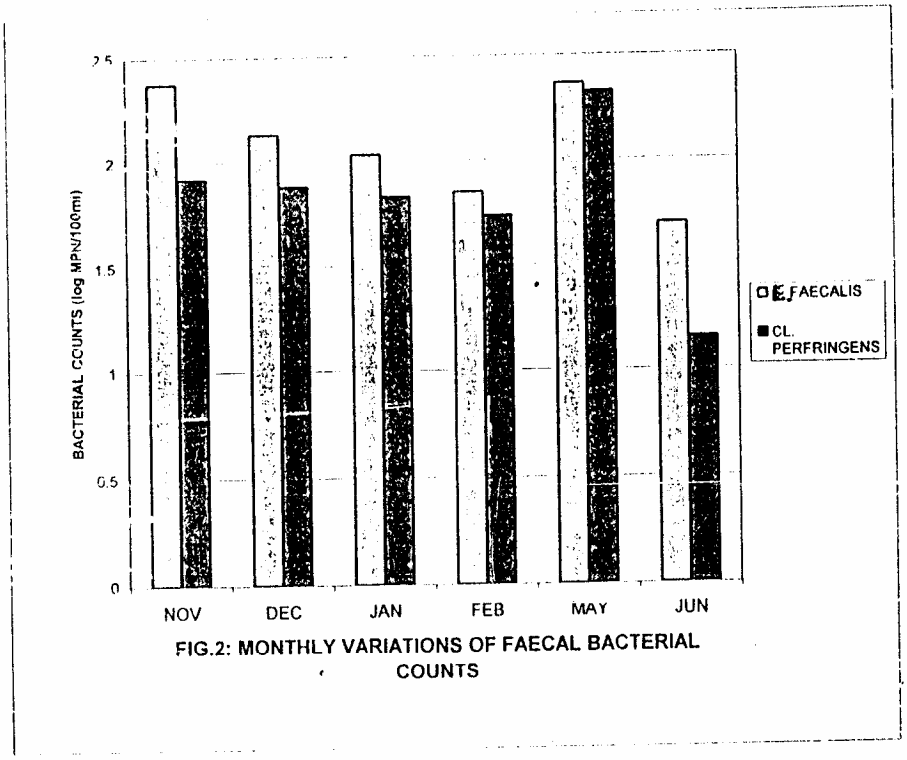


FIG.2: MONTHLY VARIATIONS OF FAECAL BACTERIAL COUNTS

At the beginning of the rainy season in May, a sharp rise in total bacterial load was observed. This rise may be due to an influx of micro-organisms carried by run off flood water into the river (Sayler *et al*, 1975, Benka-Coker and Ojior, 1995). The values for total coliform, *E. coli*, *Enterococcus faecalis* and *Cl. perfringens* counts (Fig. 2) were within the range earlier observed by Nkwodinmah (1985) on Ojirami dam, Ohagi (1993) on Ikpoba river and Amoforitse (1966) on river Ethiope. Counts of total coliform and *E. coli* were always higher than the recommended standards for potable water (WHO, 1996). This indicates that the water is not suitable for consumption as the number of coliforms and especially *E. coli* present is indicative of faecal contamination and therefore possible presence of enteropathogens. The values recorded for these bacteriological parameters were generally lower in the dry season than in the rainy season. The bactericidal effects of sunlight to which the river is exposed in some parts in this area during the dry season may play a role in reducing and keeping the load of microorganisms low (Okoronkwo and Odoyemi, 1985). The early rainy season may be the period of higher risk to the down stream users since the possibility that other enteropathogens are washed down in a similar manna cannot be ruled out. As rainfall progressed into the month of June, the dilution resulting form increased water volume, resulted in a sharp drop in the values for all the bacteriological parameters except total coliform, which did not show any change. This observation agrees with that earlier reported by Amoforitse (1996).

The presence of *Enterococcus faecalis* and *Clostridium perfringens* provided further confirmation of the faecal nature of the source of pollution of the water. Other isolates from the river such as *Pseudomonas* species, *Enterobacter* species and *Klebsiella pneumonia* (Table 1) are all normal flora of water, soil and the intestinal tract of man and animals. Some species of Pseudomonas such as *P. aeroginosa*, do infect man as opportunistic pathogen when the host defence mechanism is impaired (Atlas and Bartha, 1993). Similarly, species of Kblesiclla and Enterobacter have been incriminated as opportunistic pathogens associated with urinary tract infections, bacteraemia and wound infections (Raphael and Spencer, 1983).

The high bacteria load, and presence of indicators of faecal pollution renders this body of water unsuitable for direct consumption. In view of the foregoing, therefore, it is recommended that the water should be treated (boiled and cooled) before use to, render it safe. Rural communities should also be enlightened on the need to treat such sources of water supply before consumption to reduce the risk of water borne infections.

Table 1: Frequency of bacteria isolated from River Oroghodo.

Months	Nov.	Dec.	Jan.	Feb.	May	June
E. coli	+	+	+	+	+	+
E. faecalis	+	+	+	+	+	+
Cl. perfringens	+	+	+	+	+	+
Klebsiella sp.	-	-	-	-	+	+
Pseudomonas sp.	-	-	-	-	+	+
Enterobacter sp.	+	+	+	+	+	+

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