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内 容

原 著

- デングウイルス2型野生株による感染マウス脳の病理組織学的変化
 大杉 幸男, 前田 耕平, 吉城 豊子,
 螺良 愛郎, 大山 昭夫 261-265
- 感染強度の指標としての尿中ビルハルツ住血吸虫卵数の表現法 (英文)
 嶋田 雅暁, 平田 瑞城, 佐藤 克之,
 E. Wambayi, J. H. Ouma, 青木 克己 267-272
- ナイジェリア・ジョス高原サバンナ型回旋糸状虫仔虫の
 酸性フォスファターゼ・パターン (英文)
 G. O. Ufomadu, E. I. Braide, G. O. C. Ekejindu,
 多田 功, 高橋 弘, J. I. Akoh 273-283
- ウマブユの複数栄養生殖環に関する室内観察 (英文) 高岡 宏行 285-293
- ナイジェリア連邦共和国, ジョス高地における寄生虫調査 (英文)
 塩飽 邦憲, 高橋 弘, B. E. B. Nwoke,
 C. O. E. Onwuliri, G. O. Ufomadu 295-302
- 心房粗動を起こした三日熱と熱帯熱マラリア混合感染例について (英文)
 海老沢 功, 小原 博, 谷 莊吉 303-306
- 第27回日本熱帯医学会総会講演抄録 (3)
- 目 次 307-308
- 学生講演 309-317
- 懇話会 318-319
- 英文抄録 321-338
- 投稿規定

デングウイルス2型野生株による感染マウス脳の 病理組織学的変化

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緒 言

デングウイルスはフラビウイルスに属し、デング感染症を引き起こすウイルスとして知られている。近年東南アジアを中心にした熱帯地方において、特に小児に多発するデング出血熱 (dengue hemorrhagic fever; DHF) はこのウイルスに起因し、しばしばショック症状を伴うデングショック症候群 (dengue shock syndrome; DSS) を呈し、適切な治療をほどこさないと死に到るウイルス疾患として注目されている (Hammon *et al.*, 1960)。

DHF および DSS の病因論に関する報告は見られるが、いまだに確立されたものではない。特に症候の重症度を決定する因子がウイルス自体によるのか、それとも宿主の免疫応答の差異によるものなのか、あるいはこれら以外の何らかの因子が作用しているのか、現在のところ不明確である (Halstead, 1974, 1978, 1980; Rosen, 1977; López-Correa *et al.*, 1978; Trent *et al.*, 1983)。

従来からデングウイルスの病原性の研究には通常、マウスが用いられてきた。しかしながら分離後継代歴の少ない野生株ではマウスに対する感受性が低いため、多くの場合マウス脳に馴化した固定株が用いられて検討されてきた (Craighead *et al.*, 1966; Hotta, 1969; Cole and Wisseman, 1973)。従って、野生株を用いたマウスの実験的研究の報告は少ない。

著者らは、固定株に加えて、DHF および DSS

患者から分離された野生株を用い、哺乳マウスに感染実験を行った。しかも野生株では哺乳マウス脳に連続的に継代を行い、継代毎に脳組織を病理組織学的に観察し、マウスの症状と合わせて、ウイルス毒性の差異および変化について検索した。

実験材料および方法

ウイルス：固定株には当教室にて哺乳マウスに継代、保存された Tr 1751 株を使用した。野生株はビルマにて DHF および DSS 患者血液を *Toxorhynchites splendens* 成虫に胸腔内接種し、分離され、デングウイルス2型と同定された BR 006 株 (DHF 患者由来) と BR 116 株 (DSS 患者由来) の2株を使用した。両野生株共に *Toxorhynchites splendens* 成虫に2-3代継代した後、更に C6/36 細胞に4代継代して用いた。Tr 1751 株は感染マウス脳乳剤上清、野生株は感染培養細胞上清をそれぞれウイルス浮遊液として -80°C に保存して使用に供した。

ウイルスの定量：24穴マルチウェルプレートに単層培養した Vero 細胞を用いて、ブランク法で測定した。

マウスおよびマウス感染実験：ICR 系哺乳マウス1-2日齢を用いた。型の如く、Hanks 液にて希釈したウイルス浮遊液を脳内には 0.02 ml、腹腔内には 0.1 ml それぞれ接種した。接種ウイルス量は、脳内接種では 10^3 PFU/mouse、腹腔内接種では 10^5 PFU/mouse とした。尚、腹腔内接種

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は Tr 1751 株のみ行った。

ウイルスの継代：野生株を脳内接種後 6-8 日目に放血死させ、脳の摘出を行った。Hanks 液を用い、摘出した脳の 10% 脳乳剤を作製し、4°C、15 分間、10,000 rpm にて遠心後、その上清のウイルス定量を行った。定量後、上清を Hanks 液にて希釈したウイルス浮遊液を脳内接種し、同様の操作をくりかえし、マウス脳によるウイルスの継代を行った。尚、接種量は 10^3 PFU/mouse とした。

病理組織学的観察：Tr 1751 株接種群では発症したマウスから摘出した脳、野生株では継代毎に摘出した脳を 10% ホルマリンで固定し、パラフィン包埋後、薄切切片を作製しヘマトキシリン・エオジン二重染色を行った。

成 績

感染マウスの症状：Tr 1751 株の脳内接種群では接種後 3 日目には中枢神経刺激症状を呈するマウスが見られ、4 日目には死亡する例も見られ、5 日目には全身衰弱の経過を経て全例死亡した。腹腔内接種群では、接種後 6 日目には一部のマウスに後肢の麻痺が見られ、8-10 日目には全例、脳内接種群と同様に発症し死亡した。通常、発症後 24 時間以内に死亡した。

一方、野生株の脳内接種後の症状を観察すると、両野生株共に症状は極めて多彩であった。継代歴の少ない段階では接種後 9-12 日目頃から症状が見られ、毛を逆立ててうずくまり、体動が不活発になることが多かった。中には易興奮性の状態を呈し、全身性の振せんの出現も観察された。両野生株間に特異的な症状の差異は認められなかった。初代の脳内接種では死亡率 0-10% であったが、継代数を重ねるにつれて上昇し、5 代目では 60-70%、10 代目では 100% に達した。

脳内ウイルス量の変化：初代の脳内接種後の脳内ウイルス量は BR 006 接種群では 10^7 PFU/g、BR 116 群では 10^6 PFU/g を示し、5 代目では BR 006 接種群では 10^8 PFU/g、BR 116 群で 10^7 PFU/g を示した。10 代目では前者は 10^9 PFU/g、後者では 10^8 PFU/g であった。

病理組織学的観察：Tr 1751 株の脳内および腹腔内接種群において、血管周囲腔の円形細胞浸潤を主徴とする中等度の炎症変化が認められたが、壊死性および脱落性変化は認められなかった。

野生株の接種群の場合、継代歴の少ない段階では病理組織学的変化は軽度であり、両野生株共に

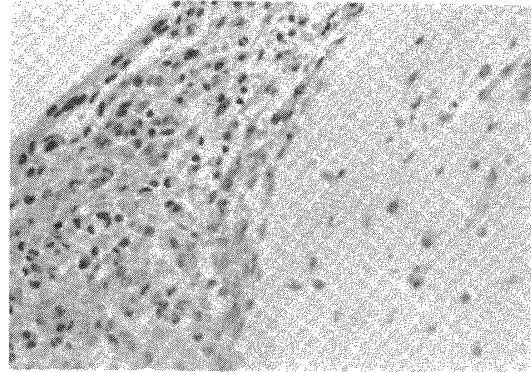


Figure 1 Mononuclear cell infiltration in subarachnoid space. (H. E. $\times 400$)

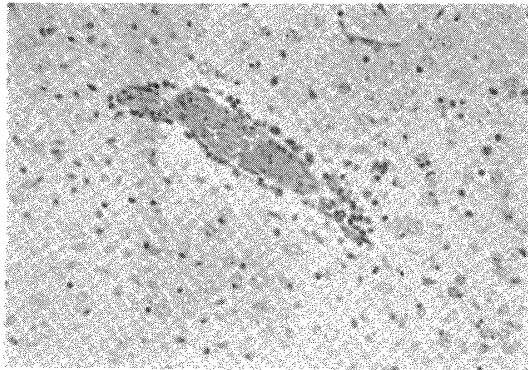


Figure 2 Mononuclear cell infiltration around a vessel in the brain. (H. E. $\times 200$)

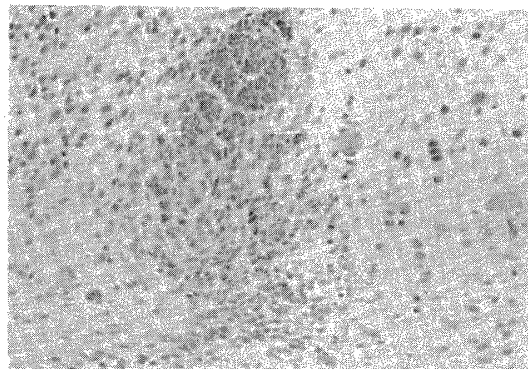


Figure 3 Focal mononuclear cell infiltration in the brain. (H. E. $\times 200$)

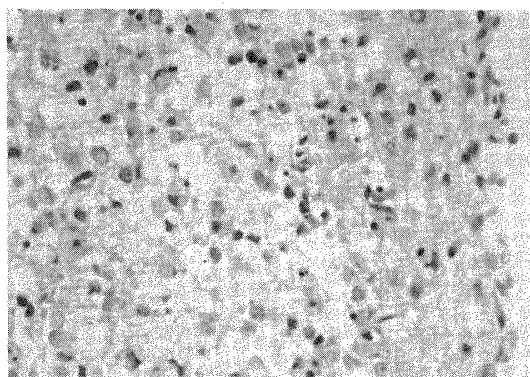


Figure 4 Necrosis appearing in the brain cortex.
(H. E. $\times 400$)

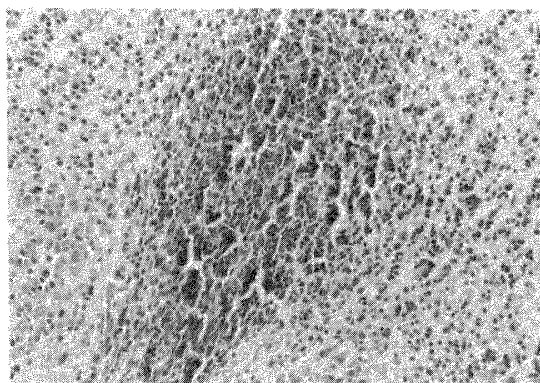


Figure 5 Distinct abscess formation in the brain.
(H. E. $\times 200$)

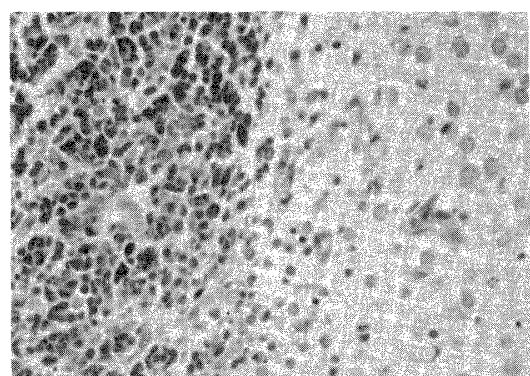


Figure 6 Higher magnification of a portion of the abscess formation in Figure 5.
(H. E. $\times 400$)

クモ膜下腔に円形細胞浸潤 (図1) が認められる程度であった。継代歴が増すにつれ、上記所見に加えて、血管周囲腔の円形細胞浸潤 (図2) や脳実質内に及ぶ巣状の円形細胞浸潤 (図3) が観察

されるようになった。継代歴が4-6代目になると、脳実質内の炎症性変化の程度は増強した。すなわち浮腫が広範囲に認められ、血管周囲腔の円形細胞浸潤がびまん性に観察された。またこの段階では脳実質内に広範囲な壊死性変化も認められた (図4)。これらの炎症性および壊死性変化はBR 006株接種群の方がBR 116株接種群よりもその程度は強かった。しかもBR 006株接種群においては、脳実質内に著明な膿瘍形成が認められた (図5, 6)。更に継代歴を増した10代目になると、脳実質内に炎症性、および壊死性変化が更に顕著に観察された。

考 察

デングウイルス固定株および野生株を用い、哺乳動物に感染実験を行い、その症状、脳内ウイルス量並びに脳の病理組織学的変化について、比較検討した。

Hotta (1969) のマウスを用いたデングウイルスの感染実験によると、脳内接種後、発症したマウスは後肢の麻痺を呈した後、24-48時間以内に死亡し、発症したマウス脳の病理組織学的観察では、血管周囲腔の円形細胞浸潤などの炎症性変化が見られたと記載されている。本実験においてもマウス固定株であるTr 1751株の接種群では同様の結果が得られた。

野生株の接種群では両野生株共に初代では中枢神経刺激症状を示したマウスは少なく、2-3代目になり発症率が高まった。しかし、症状は多彩で経過も一定せず、固定株とは明瞭な差異が認められた。8-10代目になると、症状および経過が一定するようになり、ウイルスがマウスに対して固定化する傾向が観察された。

脳内ウイルス量に関して著者らがすでに報告 (Ohsugi and Ohya, 1985; Ohsugi *et al.*, 1985) したように初代から両野生株共に 10^6-7 PFU/g と比較的高値を示すことが明らかにされており、今回の実験においては、継代数の増加により更にウイルス量の上昇が見られることがわかった。ウイルス量は初代から一定し、かつ高値を示すことから、ウイルス量とウイルスの固定化に関して明

らかな相関は得られなかった。

病理組織学的には、クモ膜下腔、血管周囲腔の円形細胞浸潤に加えて、脳実質に及ぶ炎症性および壊死性変化が見られ、継代歴が増すにつれてその程度は増強した。Cole and Wisseman (1973) は Dengue ウイルス 1 型を用い、マウス継代歴の異なる 3 種の株を哺乳マウスおよび成熟マウスに接種し、脳の病理組織学的変化の観察を行い報告している。彼らによると、哺乳マウスでは、ウイルス株の継代数の差による病理組織変化の差異は得られず、成熟マウスにおいてその差異が認められたという。また哺乳マウスでは壊死性変化の方が強く認められ、炎症性変化は軽度であったと報告している。著者らの観察結果は彼らの報告とは異なり、ウイルスのマウス継代歴によって、その病理組織変化には差異が明らかに認められ、しかも炎症性変化は決して軽度ではなく、高度に認められた。これらの所見の相違は、本実験に供したウイルス株およびマウスの種が、彼らとは異なる点も関与している可能性が大きいと考えられる。

野生株の 2 株を比較すると、DHF 患者由来の BR 006 株の方が DSS 患者由来の BR 116 株より強い病理組織変化が観察され、しかも現在までの報告では見られない、膿瘍形成が認められたことは興味深い所見であった。

要 約

DHF および DSS 患者から分離された野生株を用い、哺乳マウス脳に連続的に継代を行い、継代毎に病理組織学的観察を行い、症状および脳内ウイルス量と合わせて比較検討した。

マウス継代歴のない野生株の脳内接種では死亡率は低く、しかも脳の病理組織学的変化も軽微であったが脳内ウイルス量は比較的高値を示した。継代数が増すにつれて死亡率も上昇し、病理組織変化もその程度は増強し、血管周囲腔や脳実質に及ぶ炎症性変化が観察された。特に DHF 患者由来株では脳実質内に著明な膿瘍形成が認められた。

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PATHOLOGICAL STUDY OF MOUSE BRAIN INFECTED WITH WILD TYPE STRAINS OF DENGUE VIRUS TYPE 2

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Histological observations were carried out on the brains of mice inoculated intracerebrally (i.c.) with two wild type strains of dengue virus type 2. Mortalities of the infected mice were studied in parallel. The effects of serial passage in suckling mice were especially investigated.

Although a few death occurred after i.c. inoculation of both parent wild type strains which had not been passed in suckling mouse brain, the mortalities increased as the passage levels. By the tenth passage, the mortalities reached 100 per cent.

Both parent wild type strains produced no striking histological changes in the brains after i.c. inoculation. However by the fifth passage, diffused edema, extensive perivascular cuffs and abscess formation in the cortex of the brain were observed.

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EGG COUNT IN URINE TO DETERMINE THE INTENSITY OF *SCHISTOSOMA* *HAEMATOBIIUM* INFECTION

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Abstract: A statistical comparison was carried out among 3 different parameters, *i.e.*, egg count/volume, total egg count/sample and egg count/hour, in regards to day-to-day variations of *S. haematobium* egg output in midday urination. Among 3 parameters, the egg count/hour showed the most stable value. In addition, the total egg count in a urine sample was not correlated with the sample volume of the urine in the same individuals. We conclude, therefore, that the adoption of the egg count/hour was best as a parameter for a quantitative unit of intensity of infection for cohort studies where the changes of intensity of infection are monitored for a long period. The existing parameter for egg output expressed in terms of the egg count/10 ml volume of urine seems to be a less reliable reflection of the intensity of infection.

INTRODUCTION

In order to measure the intensity of *Schistosoma haematobium* infection, the egg count/10 ml of urine collected at midday has long been used in socio-epidemiological studies. When we used this formulation, we frequently experienced considerable fluctuations in the count value among individual persons or even in the mean of a given group as other researchers pointed out (Wilkins, 1977; Stephenson *et al.*, 1984). This fact may be due to the urine volume, which is influenced by several factors such as volume of water consumed, air temperature or relative humidity, etc. If the density of eggs in urine varies considerably with the change of urine volume, single urine sample examinations, which we usually perform in field surveys, may lead to an erroneous interpretation of the results. The ideal parameter for expressing the intensity of infection is any count value that shows the minimal daily variations among egg output data.

In this report, we compared parameters for the intensity of infection *i.e.* an existing parameter of the egg count/10 ml urine and alternatives, *i.e.* egg count/urine sample and the egg

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count/hour for their range of variations, stability and reproducibility, and found that egg count/hour was superior to the other.

MATERIALS AND METHODS

Twenty children from age 5 to 12 were selected systematically by a serial sampling among 203 pupils registered in a primary school in Mwachinga village in Kwale district, Coast Province, Kenya. Urine samples were collected from each of the children twice a day at about 11.30 and 12.30 hours for 5 days at the end of April, 1982. The times of the two urine samplings were recorded exactly.

The number of eggs in a known aliquot of each urine sample was counted by the nuclepore method (Peters *et al.*, 1976) using a membrane in 25 mm diameter with 12 micron porosity. If the eggs in the aliquot were too many or too few to count, we filtered another aliquot of the urine by adjusting the sample volume for examination for obtaining an appropriate egg count. From the egg count in the volume of urine filtered, the egg count in a 10 ml sample was calculated. The total volume of each urine sample was also measured to calculate the total egg count in the urine sample. Then, the total egg count in a sample collected at 11.30 was used for a parameter, egg count/sample, while those collected at 12.30 were expressed in terms of the egg count/sample and the egg count/hour, which was calculated by dividing by the exact time between two urinations.

Among the 20 subjects, 12 gave satisfactory data in terms of egg count/hour, but the remainder provided an insufficient number of samples or extremely low egg output. These unsatisfactory data were excluded from the analysis.

RESULTS AND DISCUSSION

Table 1 shows the daily fluctuations in the egg counts/10 ml urine of individual children. Although it was impossible from our study to know how much the total daily egg output actually varies from day to day in individuals, it was possible to determine whether the egg count/10 ml urine is influenced by the sample volume. If the number of eggs in urine increases in proportion to the urine volume, the egg count/10 ml urine sample is considered not to be influenced by the sample volume, and then can be justified for practical use as a parameter of intensity of infection.

Based on this rationale, comparisons were made among correlation coefficients between the sample volumes (Tables 2 and 3) and the total egg counts per sample (Table 4) and those per hour (Table 5) in each group of samples collected at 11.30 and 12.30. The egg count data for 5 days from individual children were standardized before calculation to avoid the influence of individual differences of egg counts and sample volumes.

As a result, we found no significant correlation between the total egg counts in urine samples and the sample volumes in both groups of samples (correlation coefficient = 0.203 and -0.081, $n=51$ and 50 respectively). In addition, the negative correlation was significant between the egg counts/10 ml and the sample volumes (correlation coefficient = -0.699 and -0.438, $n=51$ and 50 respectively).

These results indicated that the total number of eggs in the urine sample was not correlated with the urine volume. Furthermore, the increased urine volume tended to dilute the egg density in the urine. This fact has been pointed out by Wilkins (1977) and Stephenson *et al.*

Table 1 Day-to-day variation of egg count per 10 ml of urine sample collected at 11.30

| Subject No. | Day of Examination | | | | | Mean | S. D.* | C. V.** |
|--------------------|--------------------|-------|-------|-------|-------|-------|--------|---------|
| | 1 | 2 | 3 | 4 | 5 | | | |
| 1 | 1,540 | 940 | 3,300 | 3,280 | 2,730 | 2,360 | 1,070 | 45.3 |
| 2 | 100 | 380 | 60 | 270 | 60 | 170 | 150 | 84.0 |
| 3 | 440 | 310 | 630 | - | - | 460 | 160 | 35.0 |
| 4 | 710 | 360 | 380 | 400 | 280 | 430 | 170 | 38.7 |
| 5 | - | 150 | 1,050 | 730 | 510 | 610 | 380 | 61.9 |
| 6 | 240 | 120 | 190 | - | - | 180 | 60 | 33.2 |
| 7 | 180 | 120 | 200 | 190 | 460 | 230 | 130 | 58.4 |
| 8 | 740 | 1,230 | 820 | 3,320 | 660 | 1,350 | 1,120 | 82.8 |
| 9 | 90 | - | 70 | 990 | 2,330 | 870 | 1,060 | 122.1 |
| 10 | 850 | 960 | 4,000 | - | 3,800 | 2,400 | 1,730 | 72.1 |
| 11 | 410 | 60 | 90 | - | 400 | 240 | 190 | 80.0 |
| 12 | 140 | 310 | 110 | - | 2,940 | 880 | 1,380 | 157.4 |
| Average of C. V.** | | | | | | | | 72.6 |

* Standard deviation

** Coefficient of variation (%)

Table 2 Day-to-day variation of urine volume (ml) collected at 11.30

| Subject No. | Day of Examination | | | | |
|-------------|--------------------|------|------|------|-------|
| | 1 | 2 | 3 | 4 | 5 |
| 1 | 54 | 77 | 22.5 | 12.6 | 23.2 |
| 2 | 197 | 70.8 | 190 | 37 | 226.5 |
| 3 | 60 | 85.9 | 100 | - | - |
| 4 | 58 | 59.2 | 95 | 34 | 90.5 |
| 5 | - | 95 | 15.5 | 4 | 14.3 |
| 6 | 21.7 | 76.5 | 18.8 | - | - |
| 7 | 69 | 52 | 19.5 | 89 | 21 |
| 8 | 22.2 | 29 | 41 | 8.5 | 28.5 |
| 9 | 75.5 | - | 57.9 | 12.5 | 9 |
| 10 | 46 | 26.5 | 10.5 | - | 11.7 |
| 11 | 11.7 | 63 | 90 | - | 71 |
| 12 | 76 | 48.8 | 65 | - | 15.1 |

(1984). The egg count/10 ml urine sample expresses a less reliable value of intensity of infection.

The day-to-day variation among the egg counts in each group of samples at 11.30 and 12.30 was compared in terms of the coefficient of variation for 5 days. As shown in Tables 4 and 5, the average value of the coefficient of variation in the egg counts for the 12.30 samples was significantly smaller than that of the 11.30 samples ($p < 0.05$, $t = 2.64$, $df = 11$). This indicates

Table 3 Day-to-day variation of urine volume (ml) collected at 12.30, about one hour after the previous urination

| Subject No. | Day of Examination | | | | |
|-------------|--------------------|------|------|------|------|
| | 1 | 2 | 3 | 4 | 5 |
| 1 | 12.5 | 8.5 | 9.3 | 12.7 | 9.4 |
| 2 | 12 | 16.5 | 8.5 | 84 | 20 |
| 3 | 9 | 6.2 | 9.7 | - | - |
| 4 | 8.3 | 19.5 | 14 | 10 | - |
| 5 | - | 14 | 12.7 | 12.1 | 12.1 |
| 6 | 7.8 | 12.3 | 9.8 | - | - |
| 7 | 12.7 | 12.5 | 10.5 | 16 | 13.1 |
| 8 | 23.5 | 30 | 18.2 | 20.6 | 14 |
| 9 | 21 | - | 19 | 11.7 | 7.8 |
| 10 | 10.6 | 13.8 | 13.3 | - | 11.1 |
| 11 | 10.3 | 18 | 11.9 | - | 11.2 |
| 12 | 13.4 | 13.5 | 11.7 | - | 6.5 |

Table 4 Day-to-day variation of total egg count per urine sample collected at 11.30

| Subject No. | Day of Examination | | | | | Mean | S. D.* | C. V.** |
|--------------------|--------------------|-------|-------|-------|-------|-------|--------|---------|
| | 1 | 2 | 3 | 4 | 5 | | | |
| 1 | 8,320 | 7,240 | 7,430 | 4,130 | 6,330 | 6,690 | 1,590 | 23.8 |
| 2 | 1,930 | 2,690 | 1,100 | 1,010 | 1,310 | 1,610 | 700 | 43.7 |
| 3 | 2,640 | 2,660 | 6,300 | - | - | 3,870 | 2,110 | 54.5 |
| 4 | 4,120 | 2,130 | 3,590 | 1,360 | 2,550 | 2,750 | 1,110 | 40.4 |
| 5 | - | 1,440 | 1,630 | 290 | 730 | 1,020 | 620 | 60.9 |
| 6 | 520 | 910 | 360 | - | - | 600 | 280 | 47.7 |
| 7 | 1,260 | 600 | 380 | 1,670 | 970 | 980 | 510 | 52.6 |
| 8 | 1,640 | 3,570 | 3,360 | 2,820 | 1,880 | 2,660 | 860 | 32.5 |
| 9 | 660 | - | 430 | 1,240 | 2,100 | 1,110 | 740 | 67.1 |
| 10 | 3,910 | 2,550 | 4,200 | - | 4,450 | 3,780 | 850 | 22.5 |
| 11 | 480 | 370 | 810 | - | 2,840 | 1,120 | 1,160 | 103.2 |
| 12 | 1,060 | 1,510 | 740 | - | 4,560 | 1,970 | 1,750 | 89.1 |
| Average of C. V.** | | | | | | | | 53.2 |

* Standard deviation

** Coefficient of variation (%)

that the egg counts in the urine samples obtained 1 hour later at 12.30 were less fluctuated than those collected at 11.30 regardless of the previous discharge of urine.

The ideal count value to express the intensity of infection is the one which can give the least daily variation in egg count. In the present study, it was shown that the egg count/hour, which can be calculated from the 2nd sample of 2 consecutive urine samples collected at an hour interval, is a more stable parameter giving the least day-to-day fluctuation compared with other

Table 5 Day-to-day variation of egg count per hour, *i.e.*, egg count per urine sample collected at 12.30, about one hour after the previous urination

| Subject No. | Day of Examination | | | | | Mean | S. D.* | C. V.** |
|--------------------|--------------------|-------|-------|-------|-------|-------|--------|---------|
| | 1 | 2 | 3 | 4 | 5 | | | |
| 1 | 5,090 | 6,990 | 4,380 | 3,640 | 5,510 | 5,120 | 1,260 | 24.7 |
| 2 | 2,150 | 1,790 | 1,680 | 1,300 | 2,550 | 1,890 | 480 | 25.2 |
| 3 | 1,710 | 670 | 1,490 | – | – | 1,290 | 550 | 42.7 |
| 4 | 2,050 | 1,150 | 1,040 | 1,720 | – | 1,490 | 480 | 32.0 |
| 5 | – | 1,150 | 490 | 990 | 760 | 850 | 290 | 33.9 |
| 6 | 380 | 280 | 180 | – | – | 280 | 100 | 36.1 |
| 7 | 1,140 | 530 | 900 | 1,680 | 910 | 1,030 | 420 | 41.1 |
| 8 | 2,500 | 1,720 | 1,760 | 3,150 | 3,880 | 2,600 | 920 | 35.5 |
| 9 | 670 | – | 610 | 380 | 730 | 600 | 150 | 25.2 |
| 10 | 2,890 | 3,090 | 5,950 | – | 8,040 | 4,990 | 2,470 | 49.4 |
| 11 | 300 | 210 | 380 | – | 1,170 | 520 | 440 | 85.7 |
| 12 | 4,160 | 2,650 | 4,240 | – | 2,740 | 3,450 | 870 | 25.2 |
| Average of C. V.** | | | | | | | | 38.1 |

* Standard deviation

** Coefficient of variation (%)

parameters. Our results support the opinion of Clarke (1966) that intensity of infection should be expressed as the egg count excreted for a certain fixed time.

In conclusion, we considered that egg count/hour should be adopted especially for cohort studies where changes of the intensity of infection are monitored repeatedly for a long period. The disadvantage of this formulation is that the examinees are requested to bring urine samples twice within about one hour.

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感染強度の指標としての尿中ビルハルツ住血吸虫卵数の表現法

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ビルハルツ住血吸虫症では、感染の強度を表す指標として、単位尿量中の排泄虫卵数が一般的に用いられている。しかし、検査毎の虫卵数が異なるのは当然とはいえ、同じ患者から得られた検体でも、時にその日々の変動の大きさは無視できないことがある。我々は、検査毎の虫卵数が出来るだけ一定で変動の少ない方法を見いだすため、この研究を行った。

ケニア人小学生12名から、5日間午前11時30分と午後12時30分の2回採尿した。するとどちらの採尿時間のもので、その尿量と含まれる虫卵数との間には相関はなく、むしろ単位尿量中の虫卵数は、尿量と逆相関していた。また、先立つ排尿の時間を無視して午前11時30分に採尿したものと、その1時間後の午後12時30分に採尿したものの検体中の虫卵数を比較すると、午後12時30分に採尿したもののほうが日々の変動が少ないことが明らかになった。

以上の結果から、特にコホート研究においては、ビルハルツ住血吸虫症患者の感染の強度を尿中の排泄虫卵数で表す場合、単位尿量中の排泄虫卵数よりも単位時間当たりの排泄数で表現することが望ましいと考えられる。

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ACID PHOSPHATASE STAINING-PATTERNS IN THE MICROFILARIAE OF *ONCHOCERCA VOLVULUS* FROM THE GUINEA SAVANNA OF THE JOS PLATEAU, NIGERIA

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Abstract: *Onchocerca volvulus* microfilariae from 130 patients in 8 northern Guinea savanna villages of the Jos Plateau were stained by the naphthol AS-TR-phosphate method for the demonstration of acid phosphatase. Microfilariae were classified into 13 types according to their staining characteristics. Five corresponded to the enzyme types already reported by some workers on the West African rain-forest and Sudan savanna strains of *O. volvulus*. Eight types showed intense enzyme activity in the regions of the amphids and phasmids, in addition to any other structures in microfilaria.

Highly significant variations in type frequency ($p < 0.001$) were observed between microfilariae from the summit area of the Jos Plateau and those from the villages in the northern area where the Guinea savanna shares common borders with the Sudan savanna.

The multiple enzyme patterns revealed in this study indicate that the *O. volvulus* microfilariae of the Jos Plateau are more polymorphic in relation to enzyme staining than the strains of the parasite from Yemen, Guatemala, Venezuela, and the West African rain-forest and Sudan savanna. A brief background of the study area is given and the significance of these findings is discussed.

INTRODUCTION

It is now well known that the epidemiology and clinical manifestations of human onchocerciasis (river blindness) differ from one endemic region to the other. These differences have been attributed to the existence of geographical strains of *Onchocerca volvulus*. Duke (1976) recognized 6 strains of the parasite by the ability of the local *Simulium* vectors to transmit the microfilariae to man and suggested that within the main *Onchocerca-Simulium* complexes are minor complexes which are not yet clearly recognized but are different in their clinical manifestations and pathogenicity in the local population.

Histochemical method for characterization of microfilariae provides a base for differentiating

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geographical strains of *O. volvulus*. Omar and Schulz-Key (1976) observed marked differences in the distribution patterns of acid phosphatase in 3 strains of the parasite from West Africa and Guatemala. Yarzabal *et al.* (1983) showed the similarity in the frequency of the enzyme staining-patterns between the Venezuelan strain and the strains from Guatemala and Yemen, and then observed that these differed from the rain-forest and Sudan savanna strains of West Africa.

Omar (1978) also demonstrated that the proportions of the enzyme patterns in the microfilariae from the West African rain-forest and Sudan savanna, Guatemala and Yemen revealed group differences in each strain. Further, statistically significant differences were observed in the enzyme patterns of microfilarial populations in the rain-forest and Sudan savanna bioclimatic zones of West Africa (Omar *et al.*, 1982). In the work reported here we used the histochemical staining for acid phosphatase to characterize the microfilariae of *O. volvulus* in Jos area of the Guinea savanna in Nigeria.

MATERIALS AND METHODS

Geography of the study area: The Jos Plateau (1,000–1,500 metres above sea level) in the northern Guinea savanna of Nigeria although located in the tropical zone has a climate similar to the temperate regions. The northern part of this plateau shown on the map (Figure 1) is generally warmer than the summit area (Kuru), and shares borders with the arid Sudan savanna in the neighbouring Bauchi State.

The annual rain-fall (1,600–2,000 mm) on the Jos Plateau is considerably higher than other areas of northern Nigeria. The rivers that run off these highlands support the breeding of *Simulium damnosum* s.l. (Crosskey, 1981).

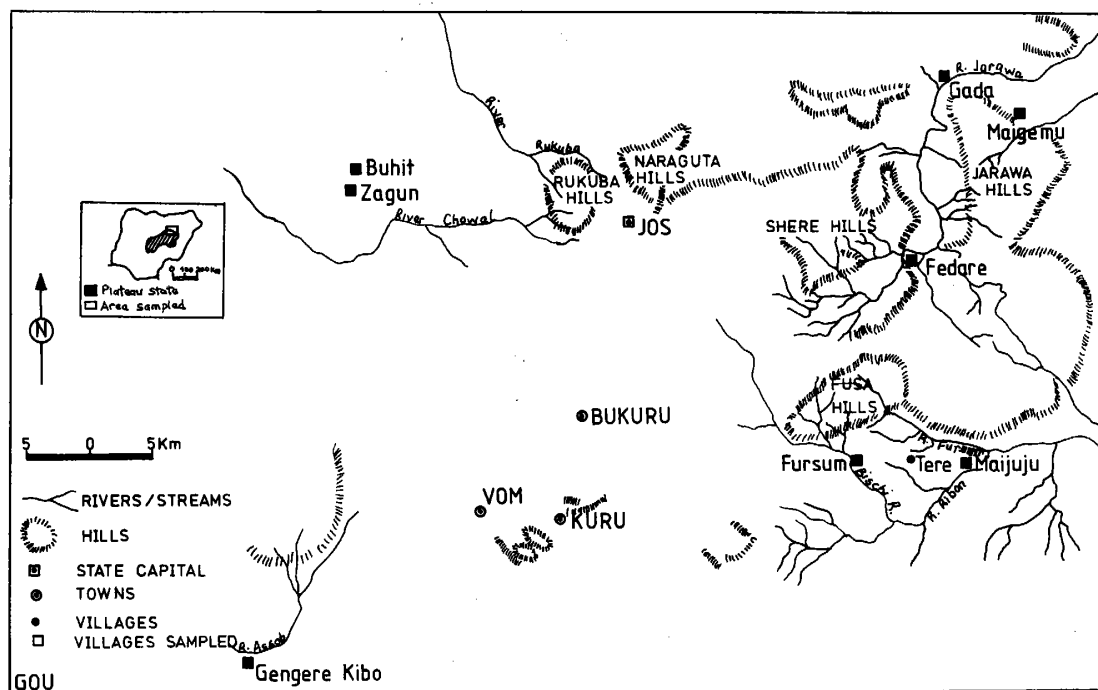


Figure 1 Map of the Jos Plateau showing sample areas (black squares), main rivers, streams and hills.

Distribution of onchocerciasis: Our epidemiological records show that onchocerciasis is hyperendemic in the villages located in the northern parts and mesoendemic in the summit area (Figure 1). In the hyperendemic villages (Gada and Maigemu), lymphadenopathy, scrotal elephantiasis, hernias and leopard skin are seen in patients. These features are less evident or completely absent in Fedare, Fursum, Maijuju and Gengere Kibo in the summit area. Generally, the prevalence of nodules is low and onchocercal blindness is much reduced in patients when compared with the savanna villages of Burkina Faso.

Collection of microfilariae: *O. volvulus* microfilariae were obtained from already known carriers of microfilariae by the skin snipping using corneo-scleral punch (2 mm Holth-type; STORTZ Ltd.) at the following locations:

- | | |
|-----------------|----------------------|
| 1. Maijuju | (9° 45' N 9° 10' E) |
| 2. Fursum | (9° 34' N 9° 06' E) |
| 3. Fedare | (10° 54' N 9° 07' E) |
| 4. Gengere Kibo | (9° 31' N 8° 37' E) |
| 5. Gada | (10° 02' N 9° 07' E) |
| 6. Zagun | (8° 42' N 9° 58' E) |
| 7. Buhit | (8° 45' N 9° 59' E) |
| 8. Maigemu | (10° 01' N 9° 11' E) |

Two skin snips were taken between 11.00 and 15.00 hours from the iliac crests of 130 microfilarial carriers and placed in Tyrode solution in flat bottom micro-titre plates. In Maigemu paired snips were taken from the scapulas, iliac crests and lower calves of 40 villagers and microfilariae from each pair were processed separately. The micro-titre wells were carefully covered using cellophane tape and each plate was numbered. Detailed data including clinical manifestations of the disease and ophthalmological examination of patients were obtained from our epidemiological records. Samples were immediately transported to our Vom laboratory for processing.

About 3 hours after collection, microfilariae from each micro-titre well were carefully pipetted onto albuminized glass slide, labelled and allowed to dry at room temperature. Each smear was immediately fixed with a few drops of cold (0–4°C) acetone and again allowed to dry at room temperature. Smears were then placed on hinged flap microscope slide folders, wrapped with cellophane material to exclude moisture and stored in a deep freezer until staining.

Staining of microfilariae: Smears of microfilariae were stained within 2 weeks of collection in incubating medium containing naphthol AS-TR-phosphate (substrate) as described by Chalifoux and Hunt (1971) at pH 5.0 and at 37°C. Each smear was stained separately in horizontal position for 2 hours by covering slides with the staining medium. The substrate was excluded from the medium used to incubate control slides. All smears were counterstained in methyl green and examined under light microscope for microfilarial acid phosphatase activity. Photomicrographs were then made as required.

Data analysis: The results were analyzed for heterogeneity and significant variations using simple Chi-square test and Friedman's two-way ANOVA by ranks.

RESULTS

The various staining patterns: Acid phosphatase activity was observed chiefly in six regions in the microfilariae of *O. volvulus*: the cephalic extremity (amphids area), between amphids and excretory vesicle, excretory vesicle, Inner body area, anal vesicle, and the phasmids in the

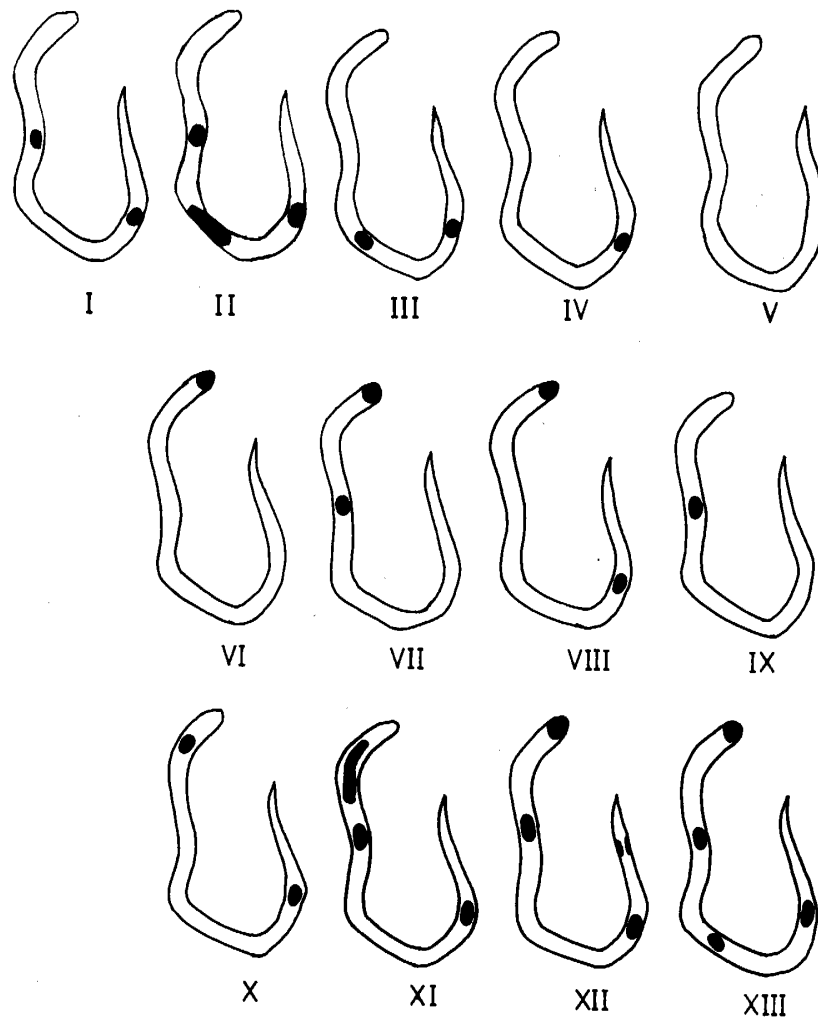
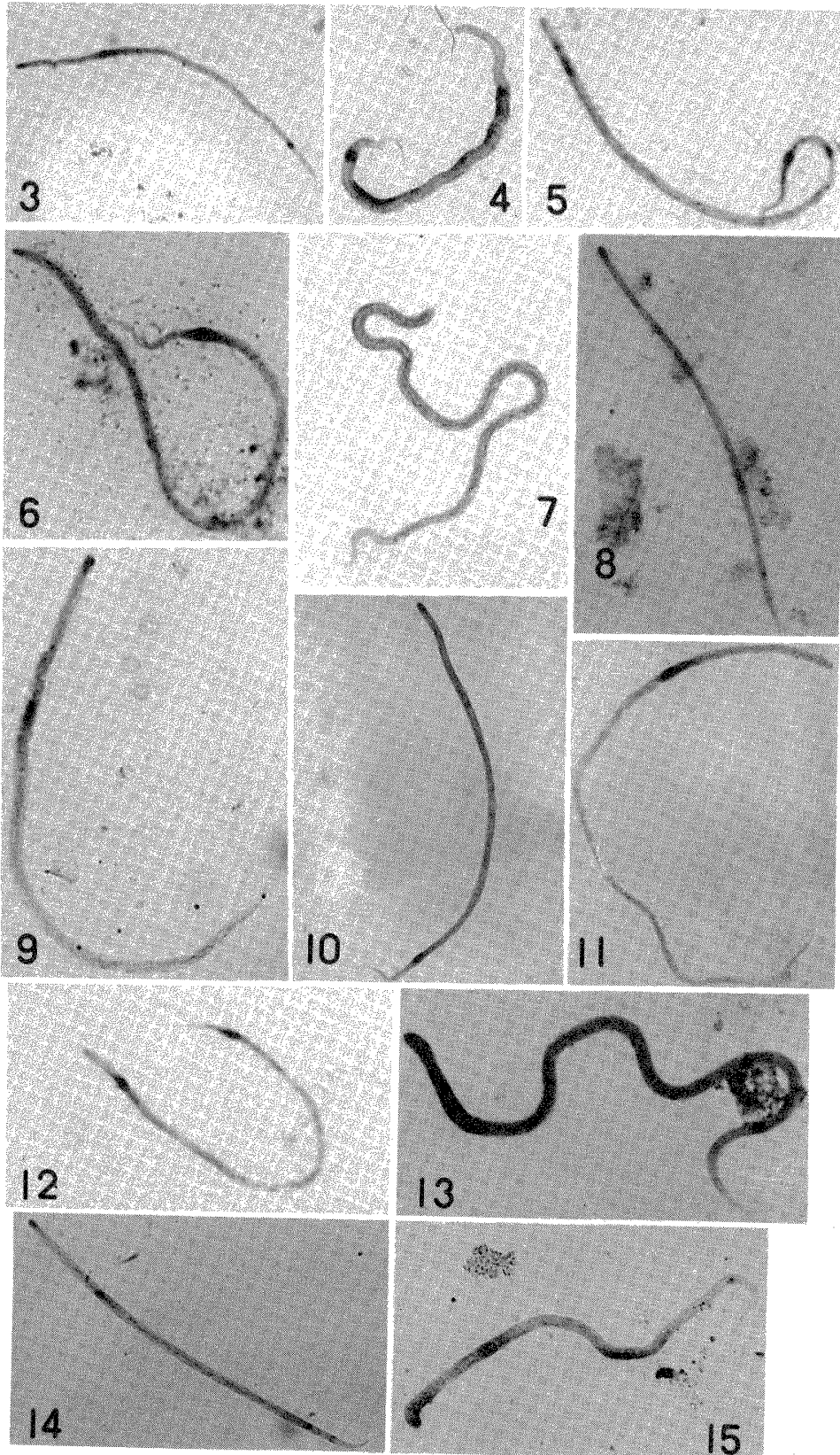


Figure 2 Schematic representation on the 13 acid phosphatase patterns in *O. volvulus* microfilariae.

Figures 3–15 Photomicrographs of the enzyme staining-patterns in *O. volvulus* microfilariae.

- 3: Excretory pore/vesicle and anal pore areas (EP + AP).
- 4: Excretory pore/vesicle and excretory cell, Inner body and anal pore areas (EP + AP).
- 5: Inner body and anal pore/vesicle areas (IB + AP).
- 6: Anal pore/vesicle only (AP).
- 7: Negative staining (NE).
- 8: Amphids (cephalic) area only (A).
- 9: Amphids (cephalic) and excretory pore/vesicle areas (A + EP).
- 10: Amphids (cephalic) and anal pore/vesicle areas (A + AP).
- 11: Excretory pore/vesicle area only (EP).
- 12: Between amphids and excretory pore, and anal pore/vesicle area (A – EP + AP).
- 13: Between amphids and excretory pore/vesicle, excretory pore and anal pore areas (A – EP + EP + AP).
- 14: Amphids (cephalic), excretory pore/vesicle, anal pore and phasmids areas (A + EP + AP + P).
- 15: Amphids (cephalic), excretory pore/vesicle, Inner body and anal pore areas (A + EP + IB + AP). All magnifications about $\times 600$.



posterior region. We identified 13 enzyme staining-patterns or types according to the presence or absence of acid phosphatase activity in the reactive structures in microfilariae. Five of these corresponded to the staining types reported by Omar (1978) and Omar *et al.* (1982). The distribution of acid phosphatase in microfilariae as revealed in the 13 patterns was: Type I-excretory pore/vesicle and anal pore/vesicle areas (EP+AP); Type II-excretory pore/vesicle, Inner body and anal pore (EP+IB+AP); Type III-Inner body and anal pore/vesicle areas (IB+AP); Type IV-anal pore/vesicle areas only (AP); Type V-complete negative staining (NE); Type VI-amphids (cephalic) area only (A); Type VII-amphids and excretory pore/vesicle areas (A+EP); Type VIII-amphids and anal pore/vesicle areas (A+AP); Type IX-excretory pore/vesicle area only (EP); Type X-between amphids and excretory pore/vesicle, and anal pore areas (A-

Table 1 Frequency distribution of the 13 staining patterns

| Village | No. of persons examined | Total No. of mf examined | Staining | | | | |
|--------------------|-------------------------|--------------------------|--------------|----------|-----------|------------|--------------|
| | | | I | II | III | IV | V |
| Maijuju and Fursum | 11 | 132 | 19 (14.4)** | 0 (0.0) | 2 (1.5) | 3 (2.3) | 16 (12.1) |
| Fedare | 26 | 455 | 128 (28.1) | 28 (6.2) | 5 (1.1) | 60 (13.2) | 22 (4.8) |
| Gengere Kibo | 4 | 10 | 0 | 0 | 0 | 4 (40.0) | 2 (20.0) |
| Gada | 30 | 646 | 52 (8.0) | 4 (0.6) | 6 (0.9) | 330 (51.1) | 123 (19.0) |
| Zagun and Buhit | 3 | 37 | 21 (56.8) | 0 | 0 | 6 (16.2) | 1 (2.7) |
| Maigemu | 56 | 3,850 | 943 (24.5) | 58 (1.5) | 104 (2.7) | 563 (14.6) | 1,278 (33.2) |
| Total | 130 | 5,130 | 1,163 (22.7) | 90 (1.8) | 117 (2.3) | 966 (18.8) | 1,442 (28.1) |

* See the text and Figure 2

** Number of microfilariae (%)

Table 2 Distribution of acid phosphatase staining

| Village | No. of persons examined | No. of the microfilarial | | | | | |
|--------------------|-------------------------|--------------------------|-----------|-----------|-----------|-----------|-----------|
| | | I | II | III | IV | V | VI |
| Maijuju and Fursum | 11 | 5 (45.5)* | 0 | 2 (18.1) | 2 (18.1) | 6 (54.6) | 0 |
| Fedare | 26 | 20 (76.9) | 10 (38.5) | 5 (19.2) | 14 (53.9) | 7 (26.9) | 1 (3.9) |
| Gengere Kibo | 4 | 0 | 0 | 0 | 3 (75.0) | 2 (50.0) | 0 |
| Gada | 30 | 10 (33.3) | 2 (6.7) | 3 (10.0) | 22 (73.3) | 22 (73.3) | 3 (10.0) |
| Zagun and Buhit | 3 | 1 (33.3) | 0 | 0 | 2 (66.7) | 1 (33.3) | 0 |
| Maigemu | 56 | 39 (69.6) | 20 (35.7) | 12 (21.4) | 39 (69.6) | 45 (80.4) | 15 (26.8) |
| Total | 130 | 75 (57.7) | 32 (24.6) | 22 (16.9) | 82 (63.1) | 83 (63.9) | 19 (14.6) |

* Number of persons (%)

EP+AP); Type XI-between amphids and excretory pore/vesicle, excretory pore and anal pore areas (A-EP+EP+AP); Type XII-amphids, excretory pore/vesicle, anal pore and phasmids areas (A+EP+AP+P); and Type XIII-amphids, excretory pore/vesicle, Inner body and anal pore areas (A+EP+IB+AP). Figure 2 shows the schematic representation of the assortments of enzyme types according to their staining characteristics in microfilariae. Enzyme activity was revealed in varying degrees of intensity from light/diffuse to intense positivity.

Figures 3-15 show the photomicrographs of acid phosphatase distribution in microfilariae. Most microfilariae stained with greater intensity in the anal and excretory pore areas, in that order, than in other structures. Staining in the cephalic (amphids) area was generally moderate while in the Inner body area enzyme activity appeared as spots or bands especially in the area of

in *O. volvulus* microfilariae (mf) from the Jos Plateau

| patterns* | | | | | | | |
|-----------|----------|-----------|-----------|----------|----------|------------|-----------|
| VI | VII | VIII | IX | X | XI | XII | XIII |
| 0 (0.0) | 7 (5.3) | 0 (0.0) | 11 (8.3) | 0 (0.0) | 0 (0.0) | 56 (42.4) | 18 (13.6) |
| 6 (1.3) | 8 (1.8) | 8 (1.8) | 15 (3.3) | 2 (0.4) | 1 (0.2) | 132 (29.0) | 40 (8.8) |
| 0 | 0 | 0 | 0 | 1 (10.0) | 0 | 3 (30.0) | 0 |
| 6 (0.9) | 3 (0.5) | 40 (6.2) | 11 (1.7) | 9 (1.4) | 3 (0.5) | 56 (8.7) | 3 (0.5) |
| 0 | 0 | 0 | 4 (10.8) | 0 | 2 (5.4) | 1 (2.7) | 2 (5.4) |
| 36 (3.8) | 67 (1.7) | 71 (1.8) | 102 (2.7) | 48 (1.3) | 55 (1.4) | 436 (11.3) | 89 (2.3) |
| 48 (0.9) | 85 (1.7) | 119 (2.3) | 143 (2.8) | 60 (1.2) | 61 (1.2) | 684 (13.3) | 152 (3.0) |

patterns of microfilariae from the Jos Plateau

| carriers with patterns: | | | | | | |
|-------------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| VII | VIII | IX | X | XI | XII | XIII |
| 2 (18.1) | 0 | 3 (27.3) | 0 | 0 | 6 (54.6) | 3 (27.3) |
| 6 (23.1) | 4 (15.4) | 8 (30.8) | 2 (7.7) | 1 (3.9) | 17 (65.4) | 8 (30.8) |
| 0 | 0 | 0 | 1 (25.0) | 0 | 1 (25.0) | 0 |
| 2 (6.7) | 5 (16.7) | 6 (20.0) | 2 (6.7) | 3 (10.0) | 10 (33.3) | 3 (10.0) |
| 0 | 0 | 1 (33.3) | 0 | 2 (66.7) | 1 (33.3) | 2 (66.7) |
| 22 (39.3) | 24 (42.9) | 25 (44.6) | 15 (26.8) | 17 (30.4) | 36 (64.3) | 25 (44.6) |
| 32 (24.6) | 33 (25.4) | 43 (33.1) | 20 (15.4) | 23 (17.7) | 71 (54.6) | 41 (31.5) |

Table 3 Acid phosphatase patterns in *O. volvulus* microfilariae from

| Location | No. of persons examined | Total No. of microfilariae | Staining | | | | |
|--------------|-------------------------|----------------------------|---------------|-------------|-------------|---------------|---------------|
| | | | I | II | III | IV | V |
| Scapulas | 11 | 306 (100%) | 40 (13.1) | 3 (1.0) | 2 (0.7) | 44 (14.4) | 132 (43.1) |
| Iliac crests | 13 | 460 (100%) | 203 (44.1) | 8 (1.7) | 3 (0.7) | 70 (15.2) | 77 (16.7) |
| Lower calves | 16 | 684 (100%) | 61 (8.9) | 2 (0.5) | 6 (0.9) | 76 (11.1) | 457 (66.8) |
| Total | 40 | 1,450 (100%) | 304 (21.0) | 13 (0.9) | 11 (0.8) | 190 (13.1) | 666 (45.9) |

the G-cell (Figures. 4, 5 and 13). In some microfilariae, strong acid phosphatase activity was observed in the cephalic region, and in the excretory pore, and very weak staining in the anal pore, while in others, staining was as in Types VI and IX in microfilariae from the same biopsy. Where there was no staining of microfilariae as in Figure 7 (Type V) (NE), the body walls were clearly delineated. There was occasional staining of the phasmids (Figure 14, Type XII). In very limited samples of microfilariae the phasmids area stained in Types IV and VIII. In Types X (Figure 12) and XI (Figure 13), the region intermediate between the amphids and the excretory pore stained as spots (Type X) or as bands (Type XI). Control slides were negative for enzyme activity.

Frequency of patterns

(i) *In microfilariae*: The relative frequency of patterns in microfilariae from the 8 villages showed a high degree of heterogeneity and the details are presented in Table 1. Due to the low number of microfilariae from these areas, and the proximity of the villages and similarity of patterns, results from Zagun and Buhit, and Maijuju and Fursum were combined.

From 130 persons, 80 males and 50 females, a total of 5,130 stained microfilariae were examined (an average of 40 parasites per carrier). Four patterns, Types I (EP+AP), IV (AP), V (NE) and XII (A+EP+AP+P), occurred more frequently in microfilariae. On the whole, Type V showed the highest frequency (28.1%) followed by Type I (22.7%), IV (18.8%) and XII (13.3%). Other staining types in our results occurred in low frequency (Table 1).

(ii) *In individual microfilarial carriers*: The distribution of enzyme patterns or staining types in individuals with microfilariae is shown in Table 2. The variation in frequency of occurrence of the 13 patterns in the 130 patients of the Jos Plateau was not significant ($p > 0.01$). All the 13 patterns were seen concurrently in 3 microfilarial carriers in Gada and in 5 patients in Maigemu. In Fedare and Maijuju areas relatively fewer microfilarial carriers harboured patterns I to XIII. Taken together, 83 microfilarial carriers representing 63.9% harboured Type V; Type IV in 82 (63.1%); Type I in 75 (57.7%); and Type XII in 71 (54.6%) (Table 3). A significantly higher percentage of Type XII was seen among carriers from Fedare and Maijuju.

(iii) *In microfilariae from scapulas, iliac crests and the lower calves*: Significant differences ($p < 0.001$) were observed in stained microfilariae from three anatomical positions: scapulas, iliac crests and the lower calves of microfilarial carriers in Maigemu where the heaviest parasitic load was observed in biopsies of carriers. Skin biopsies from the iliac crests contained a significantly

the scapulas, iliac crests and the lower calves expressed in frequency (%)

| patterns | | | | | | | |
|-------------|-------------|-------------|-------------|-------------|-------------|--------------|-------------|
| VI | VII | VIII | IX | X | XI | XII | XIII |
| 7 (2.3) | 8 (2.6) | 5 (1.6) | 13 (4.3) | 3 (1.0) | 3 (1.0) | 34 (11.1) | 12 (3.9) |
| 7 (1.5) | 8 (1.7) | 5 (1.1) | 14 (3.0) | 5 (1.1) | 2 (0.4) | 49 (10.7) | 9 (2.0) |
| 6 (0.9) | 10 (1.5) | 11 (1.6) | 20 (2.9) | 4 (0.6) | 6 (0.9) | 22 (3.2) | 3 (0.4) |
| 20 (1.4) | 26 (1.8) | 21 (1.5) | 47 (3.2) | 12 (0.8) | 11 (0.8) | 105 (7.2) | 24 (1.7) |

higher proportion of Type I (44.1%) than the other two locations. Similarly, the lower calves harboured a significant number of Type V (66.8%). Within location comparison showed a significantly higher frequency of Type V in the scapulas and lower calves (43.1% and 66.8%, respectively), and Type I (44.1%) in the iliac crests (Table 3).

(iv) *In villages and study areas*: The frequency of enzyme staining-types in microfilariae among the summit villages (Gengere Kibo, Maijuju, Fursum and Fedare) varied significantly ($p < 0.001$). Similar variations were observed in the northern areas (Zagun, Buhit, Gada and Maigemu) where the Guinea savanna shares common borders with the Sudan savanna vegetation. Overall variation within and between village groups was highly significant. The distribution of Types I, III, VI, VIII, IX, X and XI did not vary significantly between village groups; others varied significantly ($p < 0.001$).

DISCUSSION

Omar (1978) and Omar *et al.* (1982) reported 5 acid phosphatase patterns in the microfilariae of *O. volvulus* from the West African rain-forest and Sudan savanna strains of Liberia and Burkina Faso. Braun-Munzinger and Southgate (1977) described 4 patterns in the savanna villages of northern Togo also in West Africa. Four patterns were revealed in each population of microfilariae from the strains of the parasite in Guatemala, Yemen and Venezuela (Omar, 1978; Yarzabal *et al.*, 1983).

Using the same staining method we observed 13 distinct patterns in the sample of *O. volvulus* microfilariae from the northern Guinea savanna of the Jos Plateau in Nigeria. Five (patterns I–V) of the 13 patterns corresponded in staining characteristics to the enzyme types already described in the West African strains in Liberia and Burkina Faso (Omar, 1978). However, our sample differed from the rain-forest and Sudan savanna strains with regard to the frequency of patterns IV and V (Omar *et al.*, 1982). In addition, 8 other patterns (VI–XIII) were revealed in the Jos Plateau microfilariae. A significant proportion (26.4%) of the microfilariae tested for acid phosphatase in this study demonstrated these additional 8 patterns. The reason of this is that we could for the first time stain cephalic region (amphids) by the routine technique. The pre-staining condition may have revealed this result or the nature of our microfilariae might be different from the microfilariae with known enzyme activity patterns. If the latter hypothesis was true, we should consider the significance of such variations in *O. volvulus* in this study area in connection with the evolution of this species.

Patterns VI, VII, VIII, XII and XIII stained in the region of the amphids, in addition to other structures in the microfilaria; the phasmids stained in pattern XII (and occasionally, in patterns IV and VIII in a negligible number of parasites). Until this work, acid phosphatase activity in the amphids and phasmids regions was reported only among blood microfilariae e.g. *Loa loa* and *Dipetalonema perstans* (Omar and Kuhlow, 1977). Acid phosphatase activity in these structures suggests that they are metabolically active and may be involved in important functional processes (absorptive, secretory and phagocytic) (Barka, 1962). The amphidial and phasmidial cilia may also function as chemoreceptors in microfilariae (McLaren, 1972).

This histochemical study also demonstrated that the scapular region harboured more microfilariae with patterns V, I and IV and the iliac crests, those with patterns, I, V and IV, while pattern V can as well be found in relatively greater proportions in the lower calves. From this finding, it may be concluded that the frequency of each pattern is attributable to the anatomical positions of microfilariae which reflect time-lag after migration from the onchocercomata.

It is evident from the foregoing that the microfilariae of *O. volvulus* of the Jos Plateau Guinea savanna are more polymorphic in relation to enzyme staining than the strains of the parasite in Yemen, Guatemala, Venezuela, and the West African rain-forest and Sudan savanna (Omar, 1978; Omar *et al.*, 1982; Omar and Schulz-Key, 1976; Braun-Munzinger and Southgate, 1977; Yarzabal *et al.*, 1983), and may be differentiated as shown by patterns VI–XIII. It is not unlikely that a distinct strain of *O. volvulus* different from the typical Sudan savanna and the rain-forest forms exists on the Jos Plateau.

Highly significant variations were observed in the enzyme patterns in microfilariae notably from the northern and summit villages of the Jos Plateau. Pattern V was predominant in the former and pattern XII in the latter. As was mentioned previously, the Guinea savanna shares common border with the Sudan savanna vegetation in the northern area of the Jos Plateau. Onchocerciasis is severest here with all the clinical manifestations of the typical Sudan savanna form, but, surprisingly, onchocercal blindness is rare in spite of the high intensity of infection in patients. In the summit villages, lymphadenopathy, scrotal elephantiasis, hernias, leopard skin and blindness are relatively fewer (Ufomadu *et al.* unpublished observation). These discrepancies in the clinical pictures of the disease and the frequency of enzyme patterns from the 2 groups of villages are probably connected with the observation of Duke *et al.* (1966) in similar zones in the neighbouring Cameroon Republic that the Sudan savanna strain of *O. volvulus* microfilariae was incompatible with *Simulium* flies from the Guinea savanna.

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ナイジェリア, ジョス高原サバンナ型回旋糸状虫仔虫の
酸性フォスファターゼ・パターン

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ジョス高原 (ギニア型サバンナ) 8村の130名から得た回旋糸状虫仔虫の酸性フォスファターゼ活性を検討した。その結果, 13型のパターンが見出されたが, このうち5型は西アフリカの熱帯雨林およびサバンナですでに報告されたものと一致した。8型はアンフィッドとファスミッドに強い活性を示した。高地の仔虫と北方スーダン型サバンナに接する地域の仔虫との間にはパターンに差が見出された。

今回の研究によりジョス高地の回旋糸状虫仔虫は酸性フォスファターゼ活性において変異が大きく, 他の地域 (イエメン, グアテマラ, ベネズエラおよび西アフリカの熱帯雨林, サバンナ地帯) に比べて著明な差があることが判明した。

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OBSERVATIONS ON THE MULTIPLE GONOTROPHIC CYCLES COMPLETED BY *SIMULIUM TAKAHASII* (DIPTERA: SIMULIIDAE) IN THE LABORATORY

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Abstract: The newly-emerged females of the anautogenous blackfly, *Simulium (Wilhelmia) takahasii* (Rubtsov), were allowed to mate, feed on human blood and oviposit in the laboratory with an attempt to complete the multiple gonotrophic cycles. As a result, 85 of 87 inseminated flies which were fed on the blood and maintained at various constant temperatures (12°C to 28°C) oviposited, and the duration from blood feeding to oviposition tended to shorten with an increase of maintaining temperatures (i.e. median length, from 5.5 days at 12°C to 1.9 days at 26°C). The gap in time from the completion of oocyte development to oviposition gradually widened as the temperature lowered. Out of 85 flies ovipositing the first batch of eggs, 20 were fully fed on the second blood within 17 hours, and subsequently deposited eggs. Moreover, 3 of these 20 flies took the third blood and 2 of them oviposited. The lengths of duration from blood feeding to oviposition in the second and third gonotrophic cycles were 1.17 and 1.40 times as long as that in the first cycle, respectively. The mean number of eggs matured per fly reduced in the second and third gonotrophic cycles, as compared to that in the first. A single insemination has proved to enable this blackfly to produce fertile eggs at least over the first 3 gonotrophic cycles.

INTRODUCTION

Knowledge of the gonotrophic cycle (a serial event of blood feeding, oocyte maturation, oviposition and/or subsequent blood feeding) completed by female simuliids is of a fundamental importance for understanding how these flies transmit disease. The duration needed for oocyte maturation following the blood feeding was studied, using field-caught flies (e.g. Takaoka *et al.*, 1982). However, mainly due to the reluctance of the newly-emerged simuliids to take a blood meal and subsequently oviposit in the laboratory, no detailed information on the successive behavioral or physiological events of a given gonotrophic cycle was made available.

In the present study, attempts were made to complete the multiple gonotrophic cycles, using newly emerged females of the anautogenous blackfly, *Simulium (Wilhelmia) takahasii* (Rubtsov), which was reported to readily mate, blood feed and oviposit in the laboratory (Takaoka, 1985). Individual females, which completed more than one gonotrophic cycle, were then studied to obtain the data on the duration of the three main phases involved in any one of the gonotrophic cycles (i.e. from blood feeding to oocyte maturation, from oocyte maturation to oviposition, and from oviposition to subsequent blood feeding), under various temperature condi-

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tions. Furthermore, both the number of eggs laid and that of eggs hatched per female in each gonotrophic cycle were counted to determine whether any age-related changes in fecundity and fertility occurred during successive gonotrophic cycles.

MATERIAL AND METHODS

The adult *S. takahasi* used in this study were reared in the laboratory from wild-caught pupae. All females and males, the majority of which had emerged in the morning, were held together in a polyethylene bag (about 20 cm in diameter) until 17:00 on the day of emergence when the feeding trial was carried out. Most of the females were inseminated by this time. After the male flies were removed, a batch of 30–50 females were allowed to feed to repletion on my right hand which was inserted in the same bag at a room temperature (20–25°C). One hour later, each of the fully-engorged females was transferred to a polystyrene tube (10 cm long × 1.4 cm in diameter) containing ca. 3 ml of distilled water, and a strip of white paper (water proof, 7 cm long × 0.5 cm wide) half immersed in water. The tubes housing individual flies were divided into 9 groups, each consisting of 8–15 flies, and held standing in incubators at various, constant temperatures (12–28°C), and with 14-hour of light per day. No nutrients were given. Every day after blood feeding, all the flies were checked for oviposition at 6-hour intervals, arbitrary monitorings being also made especially for flies kept at higher temperatures. When oviposited eggs were found in the tube, each fly was removed and transferred to the same polyethylene bag as used for the initial blood feeding trials, and given an opportunity to feed again as soon as possible. These second feeding trials were performed with individual flies, and continued for about 30 minutes at room temperature. For those which did not refeed, another opportunity was given within 24 hours following oviposition. Only the flies fed with full second blood meals were transferred to the next ovipositing tubes, and held at the same temperature conditions as before. One day after oviposition, all the flies which failed to take blood were killed and dissected in a saline solution, except for a portion of females which were kept alive with a 35% sugar solution for a varying number of days to examine the follicular conditions following oviposition. The number of remaining mature oocytes, if present, was counted, and spermatheca was examined to confirm whether the fly had been inseminated. The flies which died before oocyte maturation were discarded, and those that survived long enough to develop mature oocytes but refused to lay eggs were also dissected upon death to ascertain whether spermatheca contained spermatozoa. A similar procedure was adopted for flies which completed subsequent gonotrophic cycles.

In order to determine the length of duration required for oocyte maturation, a portion of blood-fed flies belonging to three temperature groups (14°C, 20°C and 26°C) were dissected during the period from blood feeding to oviposition at appropriate intervals. The oocytes of stage V, which were nearly equal in size to the deposited eggs, and were ready to, on dissection, release themselves from the follicular epithelium, were judged as matured.

On the other hand, eggs deposited in each gonotrophic cycle were held in water for 5–7 days at room temperature, and the numbers of hatched and unhatched eggs were recorded to obtain the fecundity and fertility data. The term "fecundity" was used herein as the number of eggs matured per fly in a given gonotrophic cycle, and the term "fertility", as the number of eggs inseminated per fly, which was in the present study inferred from the number of eggs hatched.

RESULTS

Table 1 shows the number of females completing the first, second, and/or third gonotrophic cycles. Five of 90 fully fed flies which survived long enough to develop mature eggs did not oviposit. Three of these had no spermatozoa in their spermatheca, and were not included in Table 1. The first oviposition was completed by most of the inseminated females (97.7%). Out of 85 flies which laid eggs, 27 bit again and 20 of these took a full second blood meal and then oviposited. Eventually, only 3 flies were fully fed on the third blood, and 2 of these deposited eggs.

Table 1 Number of inseminated female *Simulium takahasii* completing the first, second and/or third gonotrophic cycles under various temperature conditions

| Temp. (°C) | Gonotrophic cycles | | | | | | | | |
|---------------|--------------------|--------------------|---------------|------------------|--------------------|---------------|------------------|--------------------|--|
| | 1 | | | 2 | | | 3 | | |
| | No. fully fed | No. ovipositing | No. biting | No. fully fed | No. ovipositing | No. biting | No. fully fed | No. ovipositing | |
| 12 | 7 | 6 | 1 | 1 | 1 | 0 | 0 | 0 | |
| 14 | 10 | 10 | 3 | 3 | 3 | 0 | 0 | 0 | |
| 16 | 12 | 11 | 5 | 5 | 5 | 0 | 0 | 0 | |
| 18 | 13 | 13 | 2 | 1 | 1 | 0 | 0 | 0 | |
| 20 | 10 | 10 | 3 | 2 | 2 | 0 | 0 | 0 | |
| 22 | 9 | 9 | 3 | 3 | 3 | 1 | 1 | 0 | |
| 24 | 9 | 9 | 2 | 2 | 2 | 0 | 0 | 0 | |
| 26 | 12 | 12 | 6 | 2 | 2 | 1 | 1 | 1 | |
| 28 | 5 | 5 | 2 | 1 | 1 | 1 | 1 | 1 | |
| Total (%) | 87 (—) | 85 (97.7) | 27 (31.0) | 20 (23.0) | 20 (23.0) | 3 (3.5) | 3 (3.5) | 2 (2.3) | |

The data on the length of durations from blood feeding to oviposition in the first gonotrophic cycle are presented in Figure 1, together with those on the duration needed for oocyte maturation. The data clearly show that although the duration from blood feeding to oviposition varied with the individual flies even at the same temperature conditions, the median length of this duration tended to shorten with an increase of maintaining temperatures (from 5.5 days at 12°C to 1.9 days at 26°C). A similar decreasing trend was observed with the length of time required for oocyte maturation, although it was measured only for three temperature groups. The gap in time from the completion of oocyte development to the oviposition (in terms of median) gradually widened as the temperature lowered (i.e. 4, 14 and 24 hours at 26°C, 20°C and 14°C, respectively). There was no definitive daily periodicity in the ovipositing behavior. The oviposition was observed not only during the light time but also during the dark. It seemed that the effect of the light-dark cycle on the length of duration from blood feeding to oviposition would have been small, if any.

The time course of the 20 flies which completed the first, second and/or third gonotrophic cycles is illustrated in Figure 2. Out of 85 flies ovipositing the first batch of eggs, 27 (including

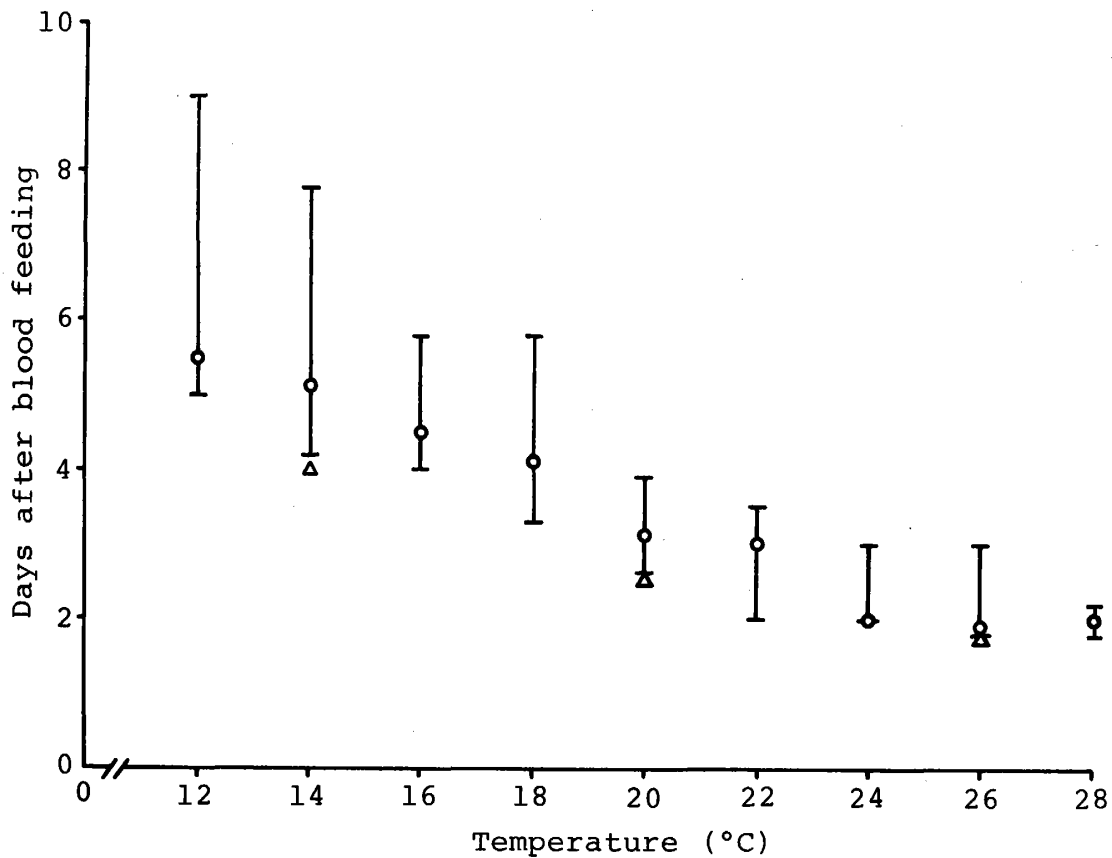


Figure 1 Length of duration from blood feeding to oviposition in the first gonotrophic cycle of *Simulium takahasii* under various temperature conditions. Circle and vertical bar signify median and range, respectively; triangle represents length of time from blood feeding to oocyte maturation.

7 incompletely fed) were observed to refeed within 24 hours: about one-third (20 flies) fed when they were given the first opportunity to take second blood (i.e. within 6 hours, but mostly less than one hour), and the remainder (7 flies), after 6–17 hours. The third blood feeding, which was observed in 3 flies, took place 15 hours (fly No. 1), one hour (No. 3) and half an hour (No. 8) following the second oviposition. Neither of the 2 flies ovipositing the third batch of eggs took a subsequent blood meal.

The duration from blood feeding to oviposition in the second gonotrophic cycle also tended to shorten, as in the first gonotrophic cycle, with the increase in temperatures under which flies were maintained (Figure 2). Although data were insufficient for the third gonotrophic cycle, it was shown that the mean length of the duration from blood feeding to oviposition was extended to some degree with the increase in the numbers of the gonotrophic cycles (i.e. relative lengths of the second and third gonotrophic cycles in relation to that of the first cycle, 1.17 and 1.4, respectively). The difference between the first and second gonotrophic cycles was statistically significant (by the paired-t test, $p < 0.001$).

Table 2 shows the fecundity data of the 20 flies in each gonotrophic cycle. There were great variations in fecundities within individual flies: from 130 to 296 in the first cycle, and from 70 to 275 in the second. However, it was clearly shown that the fecundity of any one of the 20

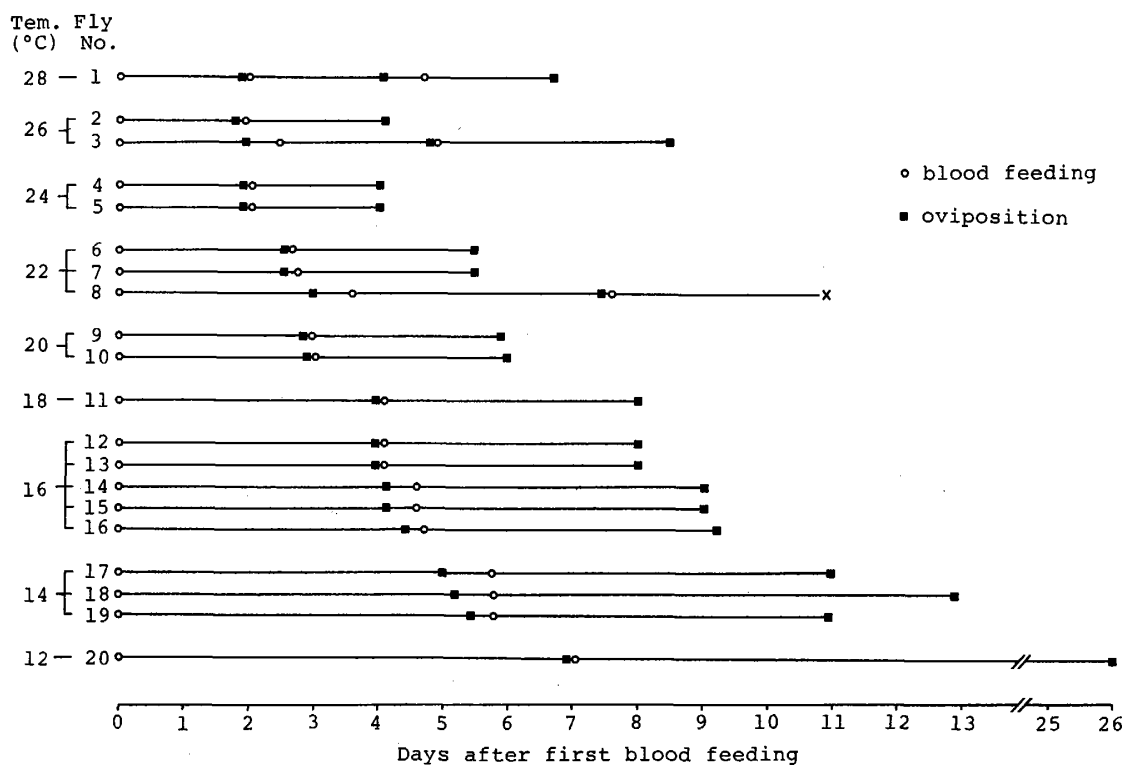


Figure 2 Time course of the 20 females of *Simulium takahasii* completing the first, second and/or third gonotrophic cycles under various temperature conditions (No. 8 fly died 3.5 days after the third blood feeding).

flies except one (No. 6) in the second gonotrophic cycle decreased by varying extents, as compared to that in the first. Fecundity in the third gonotrophic cycle was also reduced in the 2 flies but increased in the No. 8 fly, although mature eggs of this fly were not oviposited. According to the paired-t test analysis, a decrease in the mean fecundities from the first to the second gonotrophic cycle was statistically significant ($p < 0.001$).

The fertility data in terms of the number or percentage of eggs hatched are also shown in Table 2. The hatch rates greatly fluctuated within individual flies even in the same gonotrophic cycles. It should be noted that this variation was probably attributed for the most part to the sites in the ovipositing tube where eggs were laid. Eggs were either deposited in a mass on the paper, at or just below the level of water-line, or scattered on the inside surface of the upper part of the tube or cap. Most of the eggs laid in the water hatched after an appropriate incubation period. However, very few of those which were laid above the water hatched, although they were immersed in the water as soon as possible. It was then impossible to judge whether most of the unhatched eggs had been fertilized or not. However, since the hatch rates of egg batches deposited in the water (about half of the total) were high (over 80%) even in the second gonotrophic cycle, it is suggested that the second batch of eggs could have been fertilized with rates as high as the first batch of eggs by the spermatozoa stored in the spermatheca by the single mating. The hatch rates of egg batches deposited by the 2 flies (Nos. 1 and 3) in the third gonotrophic cycle were very low, 3.6% and 10.9%, respectively. Both flies were observed to oviposit their third batch of eggs scattered over the inside surface of the tube above

Table 2 Fecundity and fertility data in the first, second and/or third gonotrophic cycles of the 20 female *Simulium takahasii*

| Fly No. | Gonotrophic cycle | | | | | | | | |
|---------|-------------------|------------------|----------------|---------------|------------------|----------------|---------------|------------------|----------------|
| | 1 | | | 2 | | | 3 | | |
| | No. eggs laid | No. eggs hatched | % eggs hatched | No. eggs laid | No. eggs hatched | % eggs hatched | No. eggs laid | No. eggs hatched | % eggs hatched |
| 1 | 225* | 133 | 59.1 | 183* | 18 | 9.8 | 139*(8)# | 5 | 3.6 |
| 2 | 198* | 92 | 46.5 | 158 | 116 | 73.4 | - | - | - |
| 3 | 130* | 0 | 0 | 70* | 48 | 68.6 | 64* | 7 | 10.9 |
| 4 | 202* | 0 | 0 | 19*(131)# | 0 | 0 | - | - | - |
| 5 | 221 | 210 | 95.0 | 196 | 192 | 98.0 | - | - | - |
| 6 | 220 | 200 | 90.9 | 157*(118)# | 72 | 45.9 | - | - | - |
| 7 | 293 | 268 | 91.5 | 237 | 209 | 88.2 | - | - | - |
| 8 | 199* | 9 | 4.5 | 102* | 0 | 0 | 0 (112)# | - | - |
| 9 | 266 | 230 | 84.5 | 252 | 219 | 86.9 | - | - | - |
| 10 | 180 | 167 | 92.8 | 144 | 140 | 97.2 | - | - | - |
| 11 | 296 | 290 | 98.0 | 205 | 194 | 94.6 | - | - | - |
| 12 | 267* | 9 | 3.3 | 230* | 0 | 0 | - | - | - |
| 13 | 136* | 0 | 0 | 129 | 109 | 84.5 | - | - | - |
| 14 | 260 | 241 | 92.7 | 211 | 204 | 96.7 | - | - | - |
| 15 | 187* | 44 | 23.5 | 134 | 130 | 97.0 | - | - | - |
| 16 | 248* | 0 | 0 | 169* | 18 | 10.7 | - | - | - |
| 17 | 283 | 249 | 88.0 | 204 | 195 | 95.6 | - | - | - |
| 18 | 259 | 241 | 93.1 | 199 | 186 | 93.5 | - | - | - |
| 19 | 170* | 0 | 0 | 156*(13)# | 0 | 0 | - | - | - |
| 20 | 289 | 245 | 84.8 | 165 | 125 | 75.8 | - | - | - |
| Mean | 226.5 | 131.4 | 58.0 | 166 | 108.8 | 65.5 | 101.5 | 6 | 5.9 |

* Eggs deposited above the water

Mature oocytes remaining in the ovaries

the water. Therefore, it was difficult to assume that this low hatchability reflected the reduced fertility of these flies in the third gonotrophic cycle. Dissections made 24 hours after oviposition revealed that live spermatozoa present in the spermatheca of the 2 flies were markedly reduced in quantity, occupying only one-third or one-fourth of the entire space of the spermatheca. This indicates the possibility that there may have been an appropriate number of spermatozoa, enough to fertilize all of the third-batch eggs.

The results of dissections of the flies which completed 1, 2 and 3 gonotrophic cycles, respectively, showed that the follicular dilatations formed after oviposition were coalesced in both biparous and triparous flies, and the follicular relic technique (Detinova, 1962) was unsuitable for determining the further physiological aging in *S. takahasii*. However, the distinction of the bipars from the unipars was possible in some flies in which follicular degeneration took place in any one of the ovarioles. Two clusters of yellow granules lying in sequence but separately between the third follicle and the terminal pedicle were found in the ovarioles in which both first

and second follicles had degenerated. Another sign of the bipars was a single cluster of yellow granules formed in the degenerated primary follicle lying just below the normal follicular delatation, which was large and sac-like in form after oviposition but gradually contracted.

DISCUSSION

In the present study, nulliparous *S. takahashii* were observed to take 1.75, 2.5 and 4 days for oocyte maturation at 26°C, 20°C and 14°C, respectively. However, under these temperatures, the majority of these females oviposited, respectively, 4, 14 and 24 hours after mature oocytes were developed. This suggests that oviposition tends to be retarded at lower temperatures.

It was further demonstrated that both uniparous and biparous females could take a subsequent blood meal as early as within one hour after oviposition, if given a chance. This finding is consistent with the fact that a proportion of parous flies caught while biting in the fields carried the ovarioles with a large sac-like delatation which was generally persistent for about 12 hours after oviposition (Garms, 1975; Cupp and Collins, 1979; Watanabe *et al.*, 1980).

Le Berre *et al.* (1964) suspected that 4 days were required for the first gonotrophic cycle of *S. damnosum* in Africa and one day more for the subsequent cycles. The present results indicate that the second and third gonotrophic cycles, in terms of the duration from blood feeding to oviposition, were 1.17 and 1.4 times as long as that of the first cycle.

The fecundity was reported to decrease with an increase in physiological aging based on the comparison of the average number of eggs produced per fly between the nulliparous and parous flies (Abdelnur, 1968; Lewis, 1958; Mokry, 1980b). A similar age-related decreasing tendency has been observed in the present study where comparisons were made with the individual flies. It should be, however, mentioned that the fecundities in the second gonotrophic cycle were very slightly reduced in some females, and even increased in one female. Moreover, there were great variations in fecundities even in the same gonotrophic cycles. For these reasons, it seems difficult to distinguish, among parous flies, the physiological ages by means of the grade of fecundity levels, as attempted by Mokry (1980a) with *S. damnosum*.

There was no data indicating whether a single insemination would be enough for a female fly to secure that all of the eggs produced during her life would be fertilized. A clear evidence was provided by the fact that the second batches of eggs of most females and the third batches of eggs of 2 females successfully hatched. However, although hatchability in the second gonotrophic cycle was as high as that in the first, the same rate in the third was very low. The results of the dissections of the 2 flies ovipositing the third batch of eggs revealed that live spermatozoa were still present, occupying one-third or one-fourth of the whole space of the spermatheca, and that a considerable number of ovarioles (221 and 80, respectively) were active, each bearing the fourth follicle of stage II. This may suggest that at least one more batch of eggs, if matured by the subsequent blood meal, can be fertilized.

There was no direct observation of the number of gonotrophic cycles a simuliid can repeat during her lifetime, although 2 to 5 gonotrophic cycles were reported to be completed by certain species of blackflies in the fields (Detinova and Beltiukova, 1958; Shipitsina, 1962a, b; Davies, 1961; Arkhipova, 1966; Magnarelli and Cupp, 1977) by the ovarian relic technique (Detinova, 1962). In the present study, a maximum number of 3 gonotrophic cycles were completed by 2 flies. For the reasons noted above, these flies' potentiality to develop a fourth batch of eggs is

suggested, if a subsequent blood meal is taken.

The follicular relic method, used for determining the physiological ages in certain simuliids as mentioned above, has proved unsuitable for use in *S. takahasii*, as already reported in other blackflies, e.g. *S. damnosum* (Lewis, 1958) and *S. ochraceum* (Cupp and Collins, 1979). It is, however, noteworthy that the biparous *S. takahasii* could be distinguished from the unipars, if ovarioles in which follicular degeneration had occurred were examined.

In view of the fact that a wild blackfly takes some nutrition other than blood, such as floral nectar (e.g. Hunter, 1977), further studies are needed to determine how sugar feedings influence serial behavioral and physiological events involved in a given gonotrophic cycle.

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ウマブユの複数栄養生殖環に関する室内観察

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ブユでは、同一雌成虫について複数の栄養生殖環を観察した報告はほとんどない。今回、室内で羽化、交尾したウマブユの雌成虫を人から吸血させ、異なる温度条件下 (12-28°C) で個別に飼い産卵までの期間を調べた。産卵した個体では再吸血を試み、同様の観察を行った。その結果、初回吸血ブユ87個体のうち85個体が産卵した。このうち20個体が2回目の吸血・産卵を、さらに、このうち2個体が3回目の吸血・産卵をした。吸血から産卵までの期間の長さは、各温度条件内でも変動がみられたが、温度が低くなる程、長くなった (1.9日-5.5日)。再吸血は産卵直後から1日以内でみられた。2回目および3回目の吸血から産卵までの平均の長さは、それぞれ初回の1.17および1.4倍であった。1個体当たりの平均成熟卵数は226.5 (初回), 179 (2回目) および107.7 (3回目) と減少した。1回の交尾で、2回目以降に産下された卵からも幼虫が孵化した。2回目の孵化率は初回とほぼ同率であったが、3回目は低かった。

PARASITOLOGICAL SURVEYS IN THE JOS PLATEAU, NIGERIA

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Abstract: Surveys for schistosomiasis, intestinal parasitic infections and filariasis were carried out in 3 villages of the Jos Plateau, Nigeria, in the period between February and March, 1985. Of 668 fecal samples, 66.8 % were found to harbour parasitic eggs and protozoa. The overall prevalence of parasitic infections among villagers was as follows: hookworm, 40.3%; *Ascaris lumbricoides*, 9.1%; *Strongyloides stercoralis*, 0.3%; *Trichuris trichiura*, 0.4%; *Schistosoma mansoni*, 18.9%; *Taenia* sp., 0.1%; *Hymenolepis nana*, 0.1%; and cysts of *Entamoeba histolytica*, 6.7%; *Entamoeba coli*, 31.4%; *Iodamoeba bütschlii*, 11.1%; *Endolimax nana*, 2.5%; *Chilomastix mesnili*, 1.6%; *Giardia lamblia*, 1.5%. Hookworm was the predominant helminth, and the infective larvae of *Necator americanus* were found in 6 pupils using filter paper-cultures. The prevalence rates of hookworm infection varied significantly with villages; 53.9% at Sop, 33.3% at Jebu and 6.0% at Maigemu. Of the 344 inhabitants, 5.2% and 13.4% were found to harbour microfilariae of *Loa loa* and *Dipetalonema perstans*, respectively. Factors which may have contributed to the spread of these parasitic infections on the Jos Plateau are discussed.

INTRODUCTION

Nearly half of the people in Nigeria are living in the rural areas, and are engaging in farming. Water supply, sewage and refuse disposal are poorly organized in the rural areas. The villagers usually defecate directly on the ground. Propagations of helminths and protozoa are therefore facilitated by this practice. A report on the stool examination for ova and cysts by Azikiwe (1984) was the only available one on the parasitological situation in the Jos Plateau. He reported that hookworm and *A. lumbricoides* were the most common parasitic infestation, and *T. trichiura*, *E. coli*, *S. stercoralis*, *S. mansoni* and *G. lamblia* were found in 190 employees and their family members and 47 students of the University of Jos.

Between February and March, 1985, the inhabitants in 3 villages of the Jos Plateau were surveyed for filarial infections, schistosomiasis and intestinal parasitic infections with the aim of providing base line parasitological data.

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MATERIALS AND METHODS

Study areas: The Jos Plateau is located in the central part of Nigeria, approximately 104 km from north to south, and 80 km from east to west. It rises steeply in the south-west by a 600 m scarp from a height of 750 m to a height of over 1,300 m above sea level. Most parts of the Plateau lie on this elevation except the Shere Hills which rise to heights of over 1,800 m (Figure 1). The vegetation of the Jos Plateau is the typical northern Guinea savanna. In Jos 94% of the rains fell within the 6 wet months of April to September in 1984. There was no rainfall between November and February during which period the relative humidity was low. The temperature varied between 12 and 32°C. The hottest month was March, and coincides roughly with the passage of the sun overhead. Two periods of low temperatures were re-

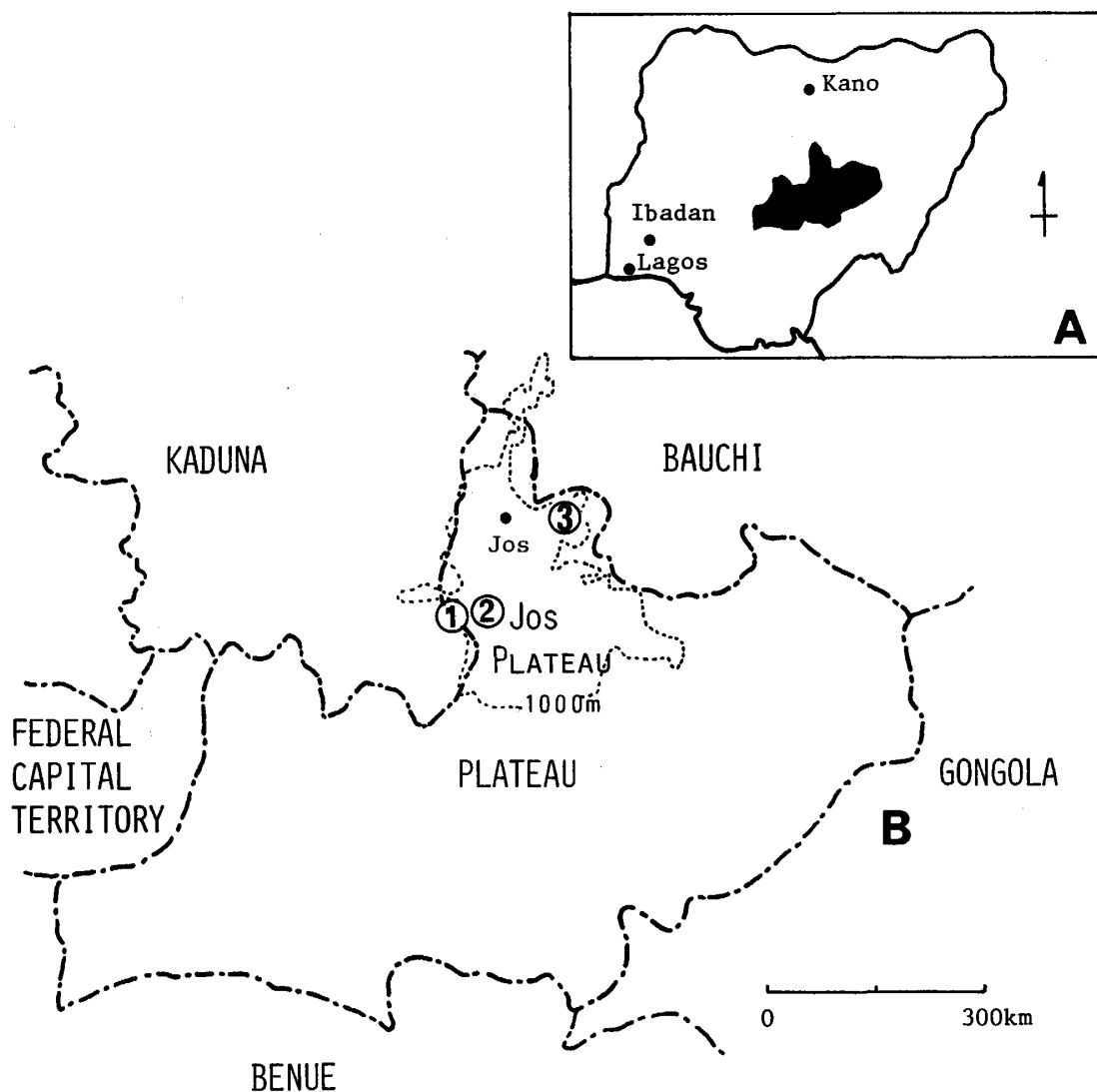


Figure 1 A: Map showing the location of Plateau State (black portion) in Nigeria.
 B: Map showing 3 villages examined in the Jos Plateau.
 ①: Sop, ②: Jebu, ③: Maigemu

corded. The first occurs in the middle of the wet season; the second coolest period occurs in the middle of the dry season as a result of the cool north-east hamattan wind from the Sahara Desert.

Three villages were selected for parasitological surveys on the Jos Plateau (Figure 1). Sop and Jebu lie within the Bauchi Local Government area in the south along the bank of the river Assob at a height of 800 m. These 2 villages are close to each other and the river Assob is the perennial one. Sop has many springs and Jebu, an irrigation canal. Maigemu lies within the Jos Local Government area in the north along the bank of the river Jarawa at a height of 720 m. The tributary of the river Jarawa near Maigemu is seasonal, and there are only some muddy puddles in the dry season. The inhabitants of these 3 villages are consisted of the Jarawa, Hausa and a small number of the Fulani people.

Fecal examination: The stool samples were collected in plastic containers which were distributed to the villagers and retrieved in the next morning. Samples were preserved in 10% formalin solution, and were examined after formalin-ether centrifugation technique (MGL method) by light microscopy. Filter paper-culture method was applied for fecal samples from 6 pupils at Sop to identify the species of hookworm.

Blood examination: Blood samples were taken from the finger tip at Sop and Jebu, and by veni-puncture at Maigemu during the time from 10 a.m. to 4 p.m. Thick films were prepared, dried overnight, dehemoglobinized, fixed by absolute methyl alcohol and stained with Giemsa.

Statistical analysis of the results: Statistical differences of parasite infections in 3 villages were assessed by ANOVA among the inhabitants aged 10 years old and more, as no subject below 9 years old was examined at Maigemu.

RESULTS

A total of 668 fecal samples of the inhabitants from 3 villages were examined and 446 (66.8%) were found to harbour parasites. The prevalence of parasitic infections was 72.8% at Sop, 55.7% at Jebu and 69.0% at Maigemu, respectively. The overall infection rate of people with individual parasites were shown in Table 1. Hookworm was the most prevalent intestinal helminth. As indicated in Table 2, the infection rate of hookworm was the highest at Sop (53.9%) and the lowest at Maigemu (6.0%). Differences in the prevalence of hookworm infection among the inhabitants at Sop, Jebu and Maigemu varied significantly ($p < 0.001$) with villages. There was no significant difference in prevalence of hookworm between males and females. Prevalence of hookworm infection at Sop was high in subjects of 10–29 years old, and low in 30 years old and more. The infective larvae of *N. americanus* were identified in all the 6 pupils at Sop using filter paper-cultures.

Table 3 demonstrates the prevalence of *S. mansoni* infection by age groups at the 3 villages. Eggs of *S. mansoni* were found in 32.9% at Sop and 4.7% at Jebu, but not at Maigemu. There were significant differences in the prevalence of *S. mansoni* infection in 3 villagers over 10 years old ($p < 0.01$) with villages. The high prevalence rate of *S. mansoni* at Sop was observed in the age group of 10–19 years old and was significantly lower in adults over 20 years old ($p < 0.005$). The highest infection rate was 61.9% in the age group of 10–19 years old at Sop. Twenty-four children below 3 years old examined were negative for the eggs of *S. mansoni*.

The overall prevalence of *E. histolytica* cyst was 6.7%; 6.2% at Sop, 6.6% at Jebu and 9.0% at Maigemu, with a peak in the age group of 10–19 years old. *E. coli* were the most common

Table 1 Prevalence of parasitic infections using formalin-ether centrifugation technique arranged by village

| Village | Sop | Jebu | Maigemu | Total |
|------------------------|---------------|--------------|--------------|---------------|
| Number examined | 356 | 213 | 100 | 668 |
| hookworm | 192 (53.9) | 71 (33.3) | 6 (6.0) | 269 (40.3) |
| <i>A. lumbricoides</i> | 19 (5.3) | 42 (19.7) | 0 | 61 (9.1) |
| <i>S. stercoralis</i> | 2 (0.6) | 0 | 0 | 2 (0.3) |
| <i>T. trichiura</i> | 1 (0.3) | 2 (0.9) | 0 | 3 (0.4) |
| <i>S. mansoni</i> | 116 (32.6) | 10 (4.7) | 0 | 126 (18.9) |
| <i>Taenia</i> sp. | 1 (0.3) | 0 | 0 | 1 (0.1) |
| <i>H. nana</i> | 0 | 1 (0.5) | 0 | 1 (0.1) |
| <i>E. histolytica</i> | 22 (6.2) | 14 (6.6) | 9 (9.0) | 45 (6.7) |
| <i>E. coli</i> | 90 (25.3) | 56 (26.3) | 64 (64.0) | 210 (31.4) |
| <i>I. bütschlii</i> | 41 (11.5) | 20 (9.4) | 13 (13.0) | 74 (11.1) |
| <i>E. nana</i> | 14 (3.9) | 2 (0.9) | 1 (1.0) | 17 (2.5) |
| <i>C. mesnili</i> | 4 (1.1) | 4 (1.9) | 3 (3.0) | 11 (1.6) |
| <i>G. lamblia</i> | 5 (1.4) | 5 (2.3) | 0 | 10 (1.5) |

Numbers in parentheses are percentage.

Table 2 Prevalence of hookworm infection by age

| Age group | Sop | | Jebu | | Maigemu | |
|-----------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | Number examined | Number infected | Number examined | Number infected | Number examined | Number infected |
| 0-9 | 157 | 67 (42.7) | 101 | 19 (18.8) | 0 | - |
| 10-19 | 113 | 84 (74.3) | 46 | 26 (29.7) | 11 | 1 (9.1) |
| 20-29 | 32 | 21 (65.6) | 29 | 11 (37.9) | 15 | 1 (6.7) |
| 30-39 | 25 | 6 (24.0) | 21 | 11 (52.4) | 31 | 3 (9.7) |
| over 40 | 29 | 14 (48.3) | 16 | 4 (25.0) | 43 | 1 (2.3) |
| Total | 356 | 192 (53.9) | 213 | 71 (33.3) | 100 | 6 (6.0) |

Numbers in parentheses are percentage.

Table 3 Prevalence of *Schistosoma mansoni* infection by age

| Age group | Sop | | Jebu | | Maigemu | |
|-----------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| | Number examined | Number infected | Number examined | Number infected | Number examined | Number infected |
| 0-9 | 157 | 38 (24.2) | 101 | 0 | 0 | - |
| 10-19 | 113 | 70 (62.0) | 46 | 4 (8.7) | 11 | 0 |
| 20-29 | 32 | 3 (9.4) | 29 | 4 (13.8) | 15 | 0 |
| 30-39 | 25 | 4 (16.0) | 21 | 1 (3.7) | 31 | 0 |
| over 40 | 29 | 1 (3.5) | 16 | 1 (6.3) | 43 | 0 |
| Total | 356 | 116 (32.6) | 213 | 10 (4.7) | 100 | 0 |

Numbers in parentheses are percentage.

Table 4 Prevalence of *Loa loa* and *Dipetalonema perstans* infections by age

| Age group | Number examined | Sop | | Number examined | Jebu | | Number examined | Maigemu | |
|-----------|-----------------|---------------|--------------------|-----------------|---------------|--------------------|-----------------|---------------|--------------------|
| | | <i>L. loa</i> | <i>D. perstans</i> | | <i>L. loa</i> | <i>D. perstans</i> | | <i>L. loa</i> | <i>D. perstans</i> |
| 0-9 | 4 | 0 | 0 | 2 | 0 | 0 | 0 | - | - |
| 10-19 | 34 | 0 | 5 (14.7) | 32 | 0 | 9 (11.6) | 15 | 1 (6.7) | 0 |
| 20-29 | 32 | 1 (3.1) | 6 (18.8) | 26 | 1 (3.9) | 3 (11.6) | 18 | 1 (5.6) | 1 (5.6) |
| 30-39 | 25 | 0 | 6 (24.0) | 23 | 0 | 1 (4.3) | 34 | 5 (14.7) | 1 (2.9) |
| over 40 | 28 | 0 | 12 (42.9) | 18 | 1 (5.6) | 0 | 53 | 8 (15.1) | 2 (3.8) |
| Total | 123 | 1 (0.8) | 29 (23.6) | 101 | 2 (2.0) | 13 (12.9) | 120 | 15 (12.5) | 4 (3.3) |

Numbers in parentheses are percentage.

intestinal protozoa showing overall infection rate of 31.4%. The infection rate of *E. coli* at Maigemu was significantly higher than those at Sop and Jebu in age groups of over 10 years old ($p < 0.005$).

Blood examination was mainly carried out on adults because of the ease in collecting blood and the lack of manpower to cope with the large number (Table 4). At Sop and Jebu, 1.3% of blood sampled showed *L. loa* microfilariae and 18.8% revealed *D. perstans*. At Maigemu, 12.5% of the inhabitants examined were positive for *L. loa* microfilariae and 3.3% for *D. perstans*. The prevalence of *L. loa* at Maigemu was significantly higher than that at Sop and Jebu ($p < 0.05$). The infection rate of *D. perstans* at Sop and Jebu was significantly higher than that at Maigemu ($p < 0.005$). The microfilarial density ranged between 1 and 72 microfilariae (mean value 6.3) for *L. loa* and between 1 and 8 microfilariae (mean value 1.5) for *D. perstans* in about 30 mm³ blood at the study areas.

DISCUSSION

Hookworm was the predominant helminth in the 3 villages of the Jos Plateau. Some reports have shown that 2 species of human hookworm, *N. americanus* and *Ancylostoma duodenale*, are seen in several parts of Nigeria (Nwosu and Anya, 1980; Udonsi, 1984). It seems

that *N. americanus* is common on the Jos Plateau as the infective larvae of *N. americanus* were identified in all of 6 pupils using filter paper-cultures.

In Jos, temperatures are consistently above the 10°C ambient, which is the minimum temperature for hookworm development (Nwosu, 1978a). Temperature may therefore have little effect on the build-up of hookworm infection in these areas. Precipitation, on the other hand, tends to have a marked seasonal pattern. As the free-living stages of hookworms are highly susceptible to desiccation (Nwosu, 1978b), low humidity in the soil would tend to reduce transmission of hookworm. Even in the dry season, there are usually many springs and streams at Sop, thus supporting a highest infection rate of hookworm; conversely, the seasonality in the tributary of the river Jarawa at Maigemu, probably explains the lower prevalence observed. Accordingly, it seems that the differences in the prevalence of hookworm among 3 villages are attributable to the differences in the humidity of soil in the dry season.

S. mansoni and *S. haematobium* are widely distributed in Nigeria (Cowper, 1963; Kaneko and Odiachi, 1976; Pugh and Gilles, 1978; Hori and Odiachi, 1978). A lot of *B. pfeifferi* were found in the springs and streams at Sop and the irrigation canal at Jebu. Snails collected from Jebu had the fork-tailed cercariae which are the characteristic of *Schistosomatoidea*. The inhabitants were probably infected at Sop and Jebu while bathing or wading in the springs, streams and irrigation canal. Recently, the spread of schistosomiasis has been fostered by increased irrigation (WHO, 1980). It must be emphasized that adequate measures for schistosomiasis control should be made an integral part of water resource development projects.

S. mansoni infection at Sop increased with age, attained a peak at 10–19 years old and declined at 20 years old or older. The reason for this reduction of prevalence remain uncertain; but accumulating evidences suggest different mechanisms such as an immune mechanism and reduced water contact in the adults (Jordan and Webbe, 1982).

A survey of intestinal protozoan infections in Nigeria was performed on a large scale by Ogunba (1977) who collected stool samples from an Ibadan population including 3,400 children and 621 adults. Prevalence of *E. histolytica*, *E. nana* and *C. mesnili* were lower in the present study area than those in Ibadan, and prevalence of *E. coli*, *I. büttchlii* and *G. lamblia* were higher in the present area than those in Ibadan. It seems that these differences in prevalence of intestinal protozoa infections are due to the differences in the climate and social environment between the present area and Ibadan.

Recently, Hori and Odiachi (1978) and Hori *et al.* (1984) carried out surveys on loiasis in the southwestern region of Nigeria in which the infection rates of 3.8–28.9% were reported. In the present surveys it is evident that the Jos Plateau is endemic area for loiasis. Using thick smears, Wijiyiratne *et al.* (1982) reported the prevalence of *D. perstans* infection of 2.6% in a village in the Malunfashi district of Kaduna State which shares borders with Plateau State. Prevalence of *D. perstans* infection at the present study villages was higher than that reported by Wijiyiratne *et al.*

ACKNOWLEDGEMENTS

We wish to thank Prof. Rokuro Kano, President of Tokyo Medical and Dental University, and Prof. M. O. E. Iwuala, Dean of Postgraduate School, University of Jos, for their encouragement throughout the present study. Thanks are also due to Prof. Kiyotoshi Kaneko, Aichi Medical University for reading the manuscript.

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ナイジェリア連邦共和国, ジョス高地における寄生虫調査

塩飽 邦憲¹・高橋 弘²・B. E. B. Nwoke³C. O. E. Onwuliri³・G. O. Ufomadu⁴

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ナイジェリア, ジョス高地の3農村の住民を対象として1985年2-3月の期間に, 糞便検査によって腸管寄生蠕虫類・原虫類およびマンソン住血吸虫の検出を, 血液厚層塗抹検査により糸状虫マイクロフィラリアの検出を行った。その結果, 糞便検査を行った668名の住民のうち, 66.8%に何らかの腸管寄生虫およびマンソン住血吸虫の寄生を認め, 寄生率は鉤虫40.3%, 回虫9.1%, 糞線虫0.3%, 鞭虫0.4%, マンソン住血吸虫18.9%, *Taenia* sp. 0.1%, 小形条虫0.1%, 赤痢アメーバ6.7%, 大腸アメーバ31.4%, ヨードアメーバ11.1%, 小形アメーバ2.5%, メニール鞭毛虫1.6%, ランプル鞭毛虫1.5%であった。6名の児童について糞便の濾紙培養検査を行い, 全てアメリカ鉤虫の感染幼虫と同定した。鉤虫の感染率は, 調査した3村で Sop 53.9%, Jebu 33.3%, Maigemu 6.0%と有意な差が認められた ($p < 0.001$)。334名の住民について血液厚層塗抹検査を行い, 5.2%の住民よりロア糸状虫マイクロフィラリアを, 13.4%より常在糸状虫マイクロフィラリアを検出した。ジョス高地におけるこれらの寄生虫疾患の分布を規定する要因について, 若干の考察を行った。

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この研究は日本-ナイジェリア医学協力事業によった (JUJIP-No. 04)。

ATRIAL FLUTTER IN A CASE OF MIXED *PLASMODIUM VIVAX* AND *P. FALCIPARUM* INFECTION

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Received April 10 1986/Accepted October 7 1986

Abstract: A rare complication of atrial flutter developed during a febrile attack in a man with *P. vivax* and *P. falciparum* (gametocyte only) infection. Until being infected with the malaria parasites, the patient had been in good health and had not noticed discomfort in the chest. The arrhythmia disappeared spontaneously after starting treatment with chloroquine. The possible role of *P. vivax* schizonts occluding capillary vessels in the myocardium is herein discussed.

INTRODUCTION

The radial pulse in patients with vivax malaria is characteristically fast and thready in the cold stage and full and bounding in the hot stage. The radial pulse in falciparum malaria is usually full and fast (Adams and Maegraith, 1978). Irregularity in pulse is rarely mentioned in patients with malaria, although it may be noticed in the terminal phase of falciparum malaria patients.

We encountered a case of mixed *P. vivax* and *P. falciparum* (gametocytes only) infection in a previously healthy man, in which atrial flutter was noticed on admission.

CASE REPORT

Case I. M., a 31-year-old male. This hitherto healthy man developed fever 2 days after leaving the Philippines where he had worked for 2 years as an agricultural instructor. It is unknown whether he had had an attack of malaria while he was in the Philippines. He was not admitted until the 15th day of illness when his temperature was 39.1°C. His blood was positive for 342 trophozoites and gametocytes of *P. vivax*, and 1 gametocyte of *P. falciparum* per 200 white blood cells. Some very young asexual (ring form) parasites with neither Schüffner's nor Maurer's dots on the red cell membrane were counted as *P. vivax* trophozoites on the basis of some undefined abnormal staining of the cell membrane of parasite-infected cells. The total parasite count was 13,510 per μ l of the blood.

Other abnormalities included low serum cholesterol of 83 mg/dl, slightly elevated serum lactic dehydrogenase 570 u/l and bilirubin 1.9 mg/dl. The serum cholesterol remained low, at 109 mg/dl, 8 days later. This low cholesterolemia is a characteristic finding in most malaria

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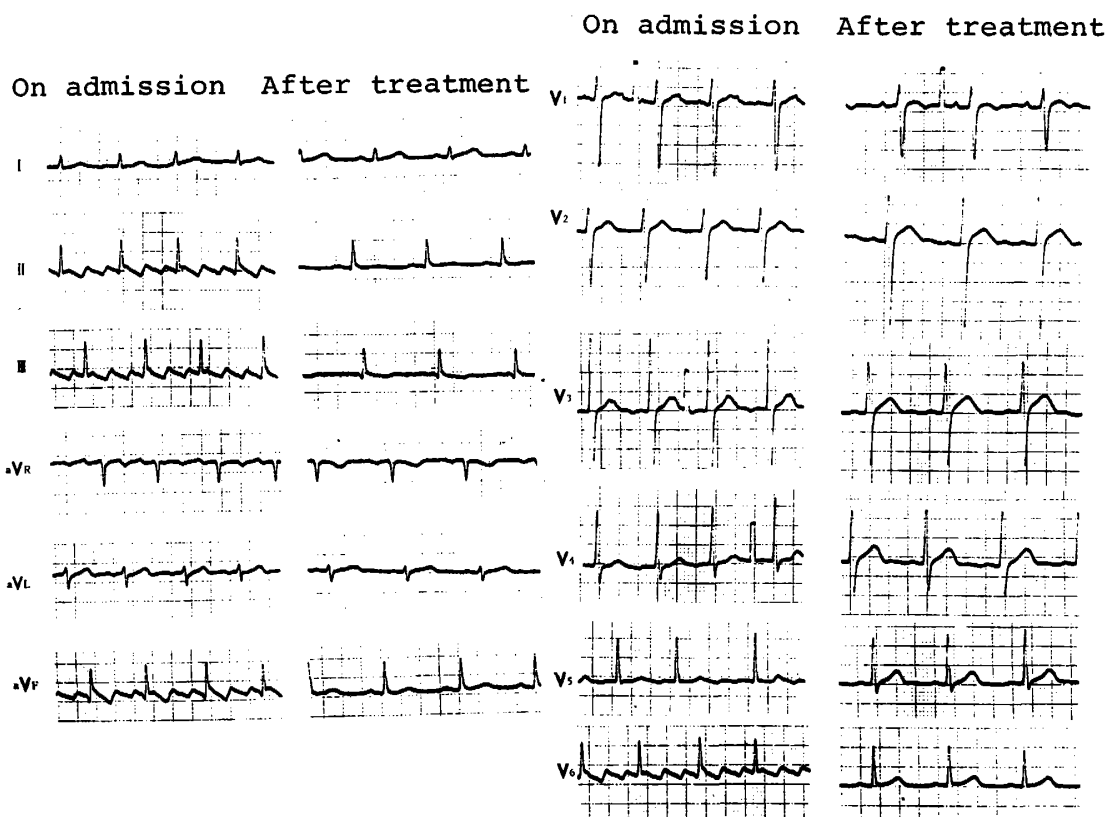


Figure 1 Electrocardiogram on admission (atrial flutter) and after treatment of malaria (normal).

patients. The HDL (high density lipoprotein), LDL (low density lipoprotein) and VLDL (very low density lipoprotein) were 18 (N=54-78), 204 (N=245-455) and 153 (N=0-110) mg/dl, respectively. The serum GOT and GPT were 21 and 22 u/l, respectively. The BUN (blood urea nitrogen) and creatinine were within normal limits. The spleen was enlarged 3 finger-breadths below the left costal margin.

He complained of discomfort in the chest on admission and electrocardiogram showed atrial flutter (Figure 1). Treatment with chloroquine, 1,500 mg base over 3 days, was started immediately. The fever subsided to a normal level 36 hours later, by which time his electrocardiogram had returned to normal. No other treatment was given for arrhythmia.

The asexual parasites of *P. vivax* became negative on the third day of admission. On the contrary, 2, 4 and 2 gametocytes of *P. falciparum* per 200 white blood cells were found on the second, third and fourth days of admission. No red blood cells infected with young trophozoite of or ring form malaria parasite and Maurer's dots on the cell membrane were found on repeated examinations throughout the course of the illness.

COMMENT

Deformability is an important character of red blood cells which have to pass through blood capillaries having a diameter of 3-5 μ m in some places (Editorial, 1978). This deformability is lost in red blood cells infected with schizonts of malaria parasites. Their altered rheologic properties were demonstrated experimentally in *P. knowlesi*-infected red blood cells of rhesus

monkeys (Miller *et al.*, 1971). This simian malaria parasite is considered to be a counterpart to human *P. malariae* (Coatney, 1971), which is the smallest malaria parasite infectious to man. Red blood cells infected with *P. malariae* are naturally smaller than those infected with schizonts of *P. vivax*, which is the largest malaria parasite infection to man.

Anatomical findings in cases of vivax malaria are very hard to obtain as the disease is usually benign. However, one of the main pathophysiological processes in malaria, irrespective of the species of malaria parasites infecting the patient, may be the disturbance of circulation in the peripheral blood capillaries as the deformability of red blood cells is impaired in the schizont-infected cells. Furthermore, the schizonts of *P. vivax* are as large as 10 μ m, and the number of schizonts in the peripheral blood is very small in comparison with the number of mature trophozoites seen on the previous day. For instance, only 3–5 schizonts among a total of 100 *P. vivax* parasites can be seen per 200 white blood cells on the day of febrile attack, although some 90–95 mature trophozoites and 5–10 gametocytes per 200 white red blood cells were seen on the previous day. This is a clear indication that many schizont-infected red cells are blocked or impacted in the small blood capillaries.

When the blockage of myocardial capillaries develops in some instances it may lead to myocardial anoxia and to disruptions of cardiac rhythms. We have seen a case of vivax malaria who developed mental confusion during a febrile attack. Sachdev and Mohan (1985) have recently reported on 6 patients with cerebral vivax malaria in children. The most probable explanation of the cause of this syndrome can be sought in the disturbance of cerebral blood flow caused by the enlarged and undeformable schizont-infected red blood cells.

Ebisawa and Tani (1980) observed a case of falciparum malaria in which schizont-infected red blood cells adhered to the endothelial cells of small myocardial blood capillaries. However, the role of *P. falciparum* parasites in the development of cardiac disorder can be excluded in this case as the asexual parasite of this species could not be confirmed, at least during the period of admission of this patient, although a few gametocytes were demonstrated during the first 4 days of admission. It is conceivable that asexual *P. falciparum* parasites might have been present at the onset of the current illness or some time before.

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心房粗動を起こした三日熱と熱帯熱マラリア混合感染例について

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マラリア患者における脈拍の性状に関しては、一般的な記載は教科書に記してあるが、不整脈の出現については殆ど記載がない。我々は三日熱と熱帯熱マラリアの混合感染例が入院時心房粗動を起こし、マラリアの治療で自然に治癒した例を経験したので報告する。患者は31歳の従来健康な男性でフィリピンから帰国後、2日目から発熱したが15病日に入院した。体温は39.1°C、末梢血液には白血球200につき三日熱マラリア原虫の栄養体と生殖母体が342個、熱帯熱マラリア原虫の生殖母体が1個あり、血液1 μ l当たり合計13,510のマラリア原虫がいた。しかし熱帯熱マラリア原虫のring formは全く検出されなかった。患者は胸内苦悶を訴えたので、心電図をとったところ心房粗動が認められた(図1)。

直ちにクロロキン療法を開始すると36時間後には平熱になった。またその頃には胸内苦悶は消失しており、心電図も正常に戻っていた。

三日熱マラリアは一般に良性で死亡例が少ないので、病理所見の記載は殆ど熱帯熱マラリアに限られている。熱帯熱マラリアでは、分裂体の感染した赤血球が脳、腎糸球体、腹膜や腸絨毛の毛細血管内に停滞して、血流障害を起こすことは良く知られている。我々は心筋内毛細血管が、分裂体感染赤血球で充満しているのを経験した。三日熱マラリアでも原虫が成熟して分裂体になると、膨大した赤血球は変形能を失い、かつ毛細管の狭い所は通過出来なくなることは容易に推定できる。三日熱マラリアの発熱発作時における頭痛、筋肉痛等は、これで説明出来よう。三日熱マラリアにおける脳症の報告例もある。従って三日熱マラリアにおいて、心筋内毛細血管が分裂体感染赤血球で充満し、心筋の酸素欠乏を起こし、心房細動を起こしたものと考えられる。

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第27回 日本熱帯医学会総会講演抄録 (3)

期 日： 昭和60年10月30日(水)-11月1日(金)
 会 場： 神戸国際会議場(神戸国際交流会館内)
 会 長： 神戸大学医学部教授 松村武男

目 次

- 特 別 講 演 (13巻2号掲載済)
- I Dengue hemorrhagic fever: a critical appraisal of current hypotheses
 Leon Rosen (ハワイ大)
- II 科学技術と国際交流
 岡本 道雄 (科学技術会議議員)
- シンポジウム (13巻2号掲載済)
- I 熱帯医学と分子疫学
 司会 石井 明 (岡山大・医・寄生虫)
 三舟求真 (大分医大・微生物)
- II 熱帯諸国と日本の医学
 司会 深井孝之助 (阪大・微生物病研究会)
 坪井 誠吉 (神戸大・医・医学研究国際交流センター)
 司会 藤岡 農宏 (県立尼崎病院)
 辻 守康 (広島大・医・寄生虫)
- III 熱帯地における旅行者感染症
 —その現状と対策を中心に—
 司会 中林 敏夫 (阪大・微研)
 青木 隆一 (大阪府立桃山病院)
- 一 般 講 演 (13巻3号掲載済)
- 学 生 講 演
- 1 タイ国の小学校における照明環境
 谷口 泰之, 久藤しおり
 (日本医大・医・6年)
- 2 タイ国チェンマイ大学の医学生気質
 齊川 茂樹, 山岸 善也
 (福井医大・4年)
- 3 思考過程に現れるイメージの分析
 一日・タイ医学生の研究—
 青木 律, 簡野 晃次
 (日本医大・医・4年)
- 4 タイ青年層の感情について
 簡野 晃次, 青木 律
 (日本医大・医・4年)
- 5 サンラサロ病院での臨床実習
 真柴 晃一 (藤田保衛大・医・4年)
 西村 朋子 (兵庫医大・医・5年)
 福田多恵子 (兵庫医大・医・4年)
- 6 レオナルド・ウッドメモリアル癩研究所訪問を通して
 田中 宏幸 (兵庫医大・熱帯医学研究会)
- 7 Bay laguna (フィリピン) での疫学研究
 脇田 和幸, 名村 宏, 児玉 明久,
 亀田 愛樹, 鈴木由美子, 巽 祥太郎,
 辻本 和雄 (神戸大・医)
- 8 サラワク・マレーシア交流会の活動を通して
 井上 雅美 (神戸大・医・3年)
- 9 タイ国北部地域における児童の皮膚疾患
 菅野 重人, 久藤しおり, 谷口 泰之
 (日本医大・医・6年)
- 10 宮古島における保健医療調査
 野原 麻子 (岡山大・医・3年)
 逸見 睦心 (岡山大・医・2年)
- 11 日本医科大学東南アジア医学研究会の活動

- 久藤しおり (日本医大・医・6年)
- 12 山梨医科大学海外医学交流研究会の活動について
 藤原 理恵, 戸田 春男, 佐藤 孝彦
 (山梨医大・5年)
 内田 直興 (山梨医大・4年)
 星野 斉之 (山梨医大・6年)
- 13 フィリピンにおけるマラリア防疫体制の現状
 戎井 力, 小倉 裕司, 岸 信之,
 高見 康二, 武田 卓, 田中 知徳,
 遠間 直人 (阪大・医)
- 14 タイにおけるマラリア意識調査
 篠原 有美, 酒井 秀樹
 (岐阜大・医・5年)
- 15 スーダン・ゲジラ地区における医療事情見学報告
 大菅 克知 (京府医大・6年)
 小林 義典 (京府医大・5年)
- 16 第6会アジア医学生会議, 4カ国におけるフィールドスタディ
 廣田 直敷 (産業医大・医・5年)
 木村 真美 (九州大・医・5年)
 岩永 資隆 (福岡大・医・4年)
- 17 柏崎難民キャンプ報告
 遠田 譲, 青木 薫
 (新潟大・医・5年)
- 18 台湾における寄生虫疾患に対する考察
 佐藤 孝彦, 藤原 理恵, 戸田 春男
 (山梨医大・5年)
 星野 斉之 (山梨医大・6年)
 内田 直興 (山梨医大・4年)

懇 話 会

医学・医療の国際技術協力

司会 松村 武男, 内山 三郎

(神戸大・医)

- 1 元研修員からの発表 (和文抄録なし)
- 1a International exchange of technical cooperation in medicine
 G. A. Ashitey
- 1b Integrated health services promote health status
 T. Tambunan
- 1c Utilization pattern of a primary health care complex in a tropical country-Bangladesh
 A. M. Z. Hussain
- 1d China and Japan cooperation promises the development of the Asian medicine
 S. Zeng
- 2 JICA 研修コースの現状と将来
- 2a 神戸大学医学部 JICA 海外受託「医科学技術」研修コース
 内山 三郎 (神戸大・医)
- 2b 大阪大学微生物病研究所における JICA 集団研修, 微生物病研修コース
 中林 敏夫 (阪大・微研)
- 2c 長崎大学熱帯医学研究所集団研修コース「熱帯医学研究」
 内藤 達郎 (長崎大・熱帯医研)
- 3 ま と め
 松村 武男, 内山 三郎 (神戸大・医)

学 生 講 演

1 タイ国の小学校における照明環境

谷口 泰之, 久藤しおり

(日本医大・医・6年)

李 明正 (日本医大・医・2年)

我々は、タイ国チェンマイの小学校において、過去多数の皮膚疾患調査を行ってきたが、いつもそのたびに感じていたことは、教室が暗いということだった。照明環境が悪く、皮膚疾患調査に支障をきたす所もあった。そこで1984年18次東南アジア医学研究会タイ国医学調査団において、実際にチェンマイ周辺の小学校の教室の照明環境について調査をした。

調査方法は、教室の中央の照明点灯時と消灯時の照度、屋外照度、窓面積の床面積に対する割合を測定し、さらに壁、天井の色調、ブラインド、雨戸、天窓の有無等について調査した。また比較の為、東京の小学校についても調査した。

その結果、チェンマイの小学校の約半数は照度不足という結果が出た。そこでその原因を床面積、天井・壁の色調、ブラインド、雨戸、天窓の有無等の点から考察した。

窓面積の床面積に対する割合は、日本に比べチェンマイではバラツキも大きく、日本における基準以下の学校が1/3あった。壁・天井の色調も、暗い色調の不適切な学校があった。雨戸はチェンマイの小学校に特徴的な型で、観音開きタイプの雨戸で取り付けている学校が多く、窓外遮光物として問題のあるものであった。天窓も取り付けている学校が多く、これは効率のよい採光という点で勧められるものである。その他、黒板の方向に問題のある学校も、2~3校あった。

結論としては、半数の教室で基準の照度を満たしていないので、改善点として 1)窓面積の確保、2)壁・天井の色調を白くすること、3)天窓の採用、4)雨戸の改善、5)人工照明の整備を上げたい。

(指導：日本医大・医・皮膚科・宗像 醇教授)

2 タイ国チェンマイ大学の医学生気質

斉川 茂樹, 山岸 善也

(福井医大・4年)

宇都木敏浩, 土田 晋也

(福井医大・6年)

福井医大生の課外活動グループである熱帯医学研究会は、1983年から年に一度ずつタイ国チェンマイ大学医学部学生と、相互訪問をしている。本年は発表者中の4年生2名が8月3日から16日まで同学生寮に滞在し、その生活や考え方など30項目余のアンケート調査を行い、結果を本学の学生生活実態調査とも比較して整理した。

調査は全学年を対象としたが、実際に回答を依頼できた者は3, 4, 5年生中の138名にとどまった。彼らの出身地は、首都バンコクと地元チェンマイを中心とする北・中部が約60%を占めたが、東・南部にも少数ずつ見られた。医学部進学動機は、成績優秀や家族のすすめをあげる一方で、国民の健康を守りたいという自負心をあげるものが約20%と目立った。学生生活の充実感は「不満」が3%で、福井医大学生の26%に比べてはるかに低かった。これは生活のレベルや、価値感の相違が根底にあるかもしれない。悩みの原因として「試験」が高率なのは、日本に比べて成績評価・進級の関門が厳しいことによる。将来の進路についての迷いは少ないが、卒後の義務年限内の地方配置や、その後の専門医選抜の「狭き門」が悩みらしい。自国の医療体制については、医師数や医療施設の不足(特に農村部)を指摘する一方で、適度・過多とする者も意外に多かった。医療費負担・診療報酬についても、同様に見方が分かれた。ただ保健態勢全般については「不備」が60%を越え、地域医療に長期従事の意志を表明する者も少なくなかった。なお、日本に対する印象は「戦後の産業の急速な発展」が多く、桜・富士山などの美意識を持つ反面、日本人は「利己的」と述べた者もあった。

(指導：福井医大・免疫寄生虫・高田伸弘助教授)

3 思考過程に現れるイメージの分析

—日・タイ医学生の研究—

青木 律, 簡野 晃次

(日本医大・医・4年)

我々はイメージ思考について調べる為に、日本とタイ国の医学部の学生を対象に、思考過程でどのようなイメージが使われているかを調べた。

日・タイ両国の医学生に全39問からなる課題を与え、それらの課題について考える際に浮かぶイメージについて記述させた。

課題は論理的課題・創造的課題・内閉的課題・感覚的課題の4種類であり、解答されたイメージは、視覚的イメージ・聴覚的イメージ・視覚聴覚混在型・その他の感覚的イメージと、言語・非言語の観点から分類した。

データの集積の結果、タイ国では日本と同様に、論理的課題に対しては視覚的、かつ言語的イメージが、内閉的課題は視覚的・非言語的イメージが、創造的課題は聴覚的・非言語的イメージの占める割合が高かった。一方感覚的課題に対しては、両国とも視覚聴覚混在型が多かったが、タイ国では、またその他の感覚的イメージのみを使用している例が10.5%みられた。感覚的イメージを単独で使用する例は皆無であったが、タイ国では全種の課題に対して現れた。

次に全39問について主成分分析を行ったところ、タイでは第一主成分(視覚因子)の高いものに、論理的・内閉的課題が抽出され、第二主成分の値の高いものに感覚的課題が抽出された。これについては、日本も似たような傾向にあった。しかし英訳問題はタイ国では第二主成分(感覚思考因子)の高い値に抽出されたが、日本では論理的課題と近い距離に現れた。これは日・タイの英語教育の相違の現れであると考えられる。また各被験者について見ると、日・タイ両国では女子は非視覚型が大部分を占めるといった同様の傾向を得た。

以上、イメージ思考について調査を行ったが、両国においてイメージの本質的な相違はないと考えられる。だが、英訳問題のような感覚的課題に

対してイメージ思考の違いがみられるので、今後課題の検討を含め更に同様の調査を続ける予定である。

(指導：日本医大・医・生理・品川嘉也教授)

4 タイ青年層の感情について

簡野 晃次, 青木 律

(日本医大・医・4年)

我々はタイ国の人々の精神構造を、感情レベルで把握することによって、病人を含めて医療に関係する人々すべてを理解し、将来の公衆衛生的接近の幅をひろげようと考えた。このために日本医科大学で開発した色彩選択テストを施行し、日・タイ両国大学生の資料の比較を行った(民族衛生, 50巻, 1号, 20-29)。

この結果興味ある点は多くみられたが、環境に対する色彩イメージにも、刺激語のもつイメージのまとまりにも、タイの特徴があった。今回はこの中、同じ肯定感情に属しながらも異なる、父親と母親の色彩イメージを、タイの庶民生活に密着している宗教環境と対比して、テスト結果の妥当性を確かめることを試みた。

タイの宗教環境は、国家的に加護された上座部仏教の組織体であるサンガへの参加を中心に、インドからのバラモン文化の影響を深く取り入れ、さらに以前からある土俗的信仰をも併せもっているという特徴がある。

しかもタイ住民にとって、これが根強く浸透しているのを見ると、父親像、母親像に関連する色彩イメージの種々な相が了解可能になるのを認めた。

(指導：日本医大・心理学・丸山芳也助教授)

5 サンラサ口病院での臨床実習

真柴 晃一 (藤田保衛大・医・4年)

西村 朋子 (兵庫医大・医・5年)

福田多恵子 (兵庫医大・医・4年)

我々は、今年で7回目を迎えるフィリピン医療研修に参加した。メンバーは兵庫医大細菌学教室柳ヶ瀬康夫先生以下、兵庫医大、藤田保衛大の医学生13名である。目的は、フィリピンの医療に触れ、日本では見る機会がほとんどない感染症を知

ることである。

研修は、フィリピンの首都、マニラの下町にあるサンラサロ病院で10日間行った。サンラサロ病院はフィリピンでも大規模な病院として有名で、チャリティーで設立、運営されている。患者は、ほとんどすべて感染症であり、フィリピンでもあまり裕福でない住民である。病院は、10の病棟からなり、それぞれ感染症によって分けられている。ここで、見た感染症はすべて印象的であったが、特に狂犬病、コレラ、破傷風、日本住血吸虫症、ジフテリアを直接みる事が出来、教科書からは学ぶことのできないものを得ることができた。今年にはフィリピンで狂犬病が流行しており、研修期間中に loma に陥った患者が、2名も入院してきたのには驚いた。また、コレラ患者が激しい脱水症状から劇的に回復していく過程や、破傷風特有の痙攣、日本住血吸虫症の肝硬変から門脈圧亢進症を起こしている典型的症例を診ることができ、非常に興味を持った。

我々は、この国にこのような多くの感染症を残している原因は、衛生意識と衛生状態の低さにあるのではないかと思った。しかし、この国では日本のように補助診断装置が発達していないため、診断の柱が理学的所見となっている。このことは我々の忘れてはならない、最も大切な診断法だと痛感した。

(指導：兵庫医大・細菌・柳ヶ瀬康夫講師)

6 レオナルド・ウッドメモリアル癩研究所訪問を通して

田中 宏幸

(兵庫医大・熱帯医学研究会)

我々は、フィリピン国・セブ島に渡り、8月20日にレオナルド・ウッドメモリアル癩研究所を訪れた。

癩は癩菌によって起こる慢性感染症で、癩菌は抗酸菌の1種であるが、他の抗酸菌にはみられない特徴として、末梢神経に対する親和性がある。癩菌の感染前後における宿主側の免疫機能の差によって、皮膚、末梢神経、諸臓器の病変に大幅な差異が生じ様々な臨床症状を呈する。細胞性免疫と病型との関係は、細胞性免疫が低下していると

ときには、菌数は少なく癩腫型を示し、細胞性免疫が比較的強いときには菌数が多く類結核型を示す。

この研究所でみた症例はすべて癩腫型で、病巣は著しく両側性で対称性であった。皮膚病巣は著しく両側性で、対称性であった。皮膚病巣は非常に多数で紅斑を伴い、表面平滑、光沢があり、耳介は大きくなり、顔のしわが粗く深くなる。獅子様顔貌で、口唇はしばしば腫大し、眉毛やまつげは薄くなり消失する。皮膚神経損傷により、進行性の glove-stocking 状の無感覚症となる。屈曲部を除く体表の大部分で、軽度の触覚、痛覚、湿度覚が失われるが位置覚はよく保たれている。さらに我々は、Punch-biopsy をみる機会にめぐまれた。あらかじめ、針を使って痛覚の消失を確認した後、麻酔をし、トレパンという器具を使って病巣から材料を取っていた。

癩の治療法は、DDS, Lamprene, Rifampicin により、現在では、根治できる疾患であり、癩をめぐる様々な偏見や差別を無くし、癩に対する正しい理解を深める必要があると思われる。

レオナルド・ウッドメモリアル癩研究所は、海外援助により設立されたものであり、おのおの施設が有効に機能しており、フィリピン人スタッフも充実しており、海外援助のあるべき姿を見たように思った。

最後に、本研修も7回を終え、回を重ねる度に研修内容も充実し、兵庫医科大学内において、熱帯医学研究会という同好会も発足した。また、研修を共にした藤田保健衛生大学、奈良県立医科大学との横のつながりも一層深まり、今後もさらに発展させていきたいと思っている。

(指導：兵庫医大・細菌・柳ヶ瀬康夫講師)

7 Bay laguna (フィリピン)での疫学研究

脇田 和幸, 名村 宏, 児玉 明久,
亀田 愛樹, 鈴木由美子, 巽 祥太郎,
辻本 和雄 (神戸大・医)

我々は、フィリピン南東 70 km の Bay laguna にて結核、寄生虫、栄養に関する調査を現在まで行っているが、以下特に栄養に関して過去3年間の結果を述べる。

フィリピンと日本の衛生問題に関する共同研究

は、神戸大学医学部国際交流センターの事業の一つであり、学生が主体となりフィールドワークを行い現地のスタッフとの交流を深めて来た。Bay laguna を地域研究の場にしたのは、ここにはフィリピン大学の CCHP (Community Comprehensive Health Programme) の事務所と、病院が設置されている事による。Bay laguna には12の村があり、無作為に数カ村を選んで調査の対象とした。

体格に関して0-6歳児を対象に、体重、身長、胸囲、頭囲、上腕中間部周囲長、皮下の厚さを測定した。結果は日本と比較して、子供の成長に遅れが認められ、特に2歳以上の子供にこの傾向が強かった。

次にカロリー摂取の測定は、20の家庭で日本食品成分表を用いて行った。3-6歳児で、1,084-1,530 Kcal/dayであった。これは日本と同程度か、やや低い値である。主食は米で、摂取カロリーの1/2-2/3をこれよりとっている。動物蛋白質の摂取は、13%と低値である(日本は14.8%)。

フィリピンの子供達の低成長の原因は、栄養と衛生の問題があると考えられる。1歳未満の乳幼児の成長の差が少ない事は、母乳が関連していると考えられる。

今回呈示した資料は、フィリピンの典型的農村のものであり、これらの知見は他の熱帯地域でもほぼ同様であると推測できる。

(指導：神戸大・医・医学研究国際交流センター・坪井誠吉助教授)

8 サラワク・マレーシア交流会の活動を通して

井上 雅美 (神戸大・医・3年)

演者は、1984年3月と1985年8月の2回、東マレーシア領サラワク州で行われたワークキャンプに参加した。当地では、サラワク州の土着民族であるイバン族と生活を共にし、貴重な体験を得ることができた(資料提供：琉球大・医・保健・宮城一郎教授)。また、1985年8月のサラワク・マレーシア交流会(SMDと略)主催のワークキャンプでは、イバン族の典型的な住居であるロングハウスにおける、屋内塵のダニ調査も行ったので、

その結果もあわせて報告した。

1. ロングハウスの構造とその住環境；この地方独特の集合住宅であり、家族生活と村落生活の一体化した特殊な居住様式である。外観は日本の長屋に似ているが、熱帯地方なので高床式となっており、床の高さは平均1.5m位である。このようなロングハウス7カ所において住環境を調査した結果、ビニールシート(床敷)の使用・屋内家具・テレビ・電化製品の普及等、近年ロングハウスにおいて都市化と近代化が著しく進んでいることがわかった。

2. ロングハウスにおける屋内塵のダニ調査；各地の3つのロングハウス(都市に近い方からK, W, Oと略)の22カ所において、小型掃除機を用い屋内塵を採取した。検出されたダニは、4亜目27科にわたる。屋内塵1g当たりの数はK 1,336頭、W 280頭、O 124頭であった。1m²当たりのダニ数はK, W, Oの順にそれぞれ167頭・47頭・21頭であった。Kにおいて他のロングハウスに比べ、ダニ数が顕著に多い。その理由として、他のロングハウスに比べ、ビニールシートの使用・冷蔵庫・テレビの普及等により、湿気も多く、ダニの住みやすい環境である為と考えられた。Kでは特に、ニクダニ科・ツメダニ科が顕著であったが、ニクダニが増加し、それを補食するツメダニが増殖したと考えられる。尚、屋内塵中にアリ類が多いことも特徴であった。

ロングハウスの構造、および屋内塵ダニ相から、当地における住環境について考察した結果、伝統的な生活体験によって作り上げられたロングハウスの生活様式に近代化が進み、このことが必ずしも住民の健康的な生活環境には結びついていないと考えられた。

(指導：神戸大・医・医動物・松村武男教授)

9 タイ国北部地域における児童の皮膚疾患

菅野 重人、久藤しおり、谷口 泰之

(日本医大・医・6年)

1966年以来、我々はタイ国における児童の皮膚疾患について、主としてチェンマイ市を中心とする北部地域において調査を継続してきている。

調査は年一回、8月に行われ、チェンマイ市の

公立・私立の小学校、およびその周辺村落にある小学校、更には Lü, Chiang Dao といった、いわゆる癩村に居住する児童を対象としている。対象の数は、年間約4,000名ほどとなる。

その結果、タイ国において、児童間にみられる皮膚疾患として頻度の高いものは、

- ①頭シラミ (pediculosis capitis), ②足爪変形 (toe nail deformity), ③口角炎 (angular stomatitis), ④点状白斑 (spotted leucoderma), ⑤膿痂疹 (impetigo), ⑥癬風 (tinea versicolor)

などであることがわかった。

これらの疾患のうち、頭シラミ、足爪変形および口角炎は、市内の小学校よりも村落部および癩村において出現頻度が高くなるという傾向がみられた。またこれらの疾患は、いずれも日本の児童よりもタイの児童の方に多くみられるという傾向もあった。

癩病が児童間に発生する頻度は極めて低く、過去15年間でわずか10例、頻度にするとも0.02%となり、皮膚症状はT型、およびI群であった。

以上の結果を考察するに、日本とタイ国における皮膚疾患の出現率の差異は、自然地理および社会文化的な要素に起因し、同じタイ国内における地域的差異は、住宅環境・栄養状態などの生活要素に基づくものと考えられる。

癩病の発生率は低値であり、癩村におけるコントロール政策が奏功していることを窺わせるが、市中の小学校においても、わずかながら発見例がある事は今後の課題である。

(指導：日本医大・皮膚科・宗像 醇教授)

10 宮古島における保健医療調査

野原 麻子 (岡山大・医・3年)
逸見 陸心 (岡山大・医・2年)

我々岡山大学医学部アジア伝統医学研究会は、過去14年間に互って現在まで、インド、タイ、ビルマ、フィリピン、台湾、中国などを毎年訪問し、各国の伝統医学の実態調査を行ってきた。現地における海外の様子を自分の眼で見る事や、様々な人との出会いは素晴らしい経験であり、これを機会に外国人留学生をはじめ、幅広い国際交流を始めている。

しかし、海外に出掛けるには多くの費用を必要とし、また国内の実状を断続調査することも大切だと考え、現在宮古島の保健医療調査を行っている。宮古島では、2つのアプローチの方法を試みている。その1つはすでにある統計資料の分析であり、他の1つは文化・生活面から医療を見ることである。離島であり、独自の文化・生活を保持している宮古島において、この2番目のアプローチは、生活基盤を知る上で大切であると思われる。特に冠婚葬祭の変化を知ることは、住民の意識の変化を知ることであり、地域医療を考える上での参考になる。例えば、墓制の変化(小規模化等)から核家族化の進行が窺える。

宗教においても、自然信仰が根強く残っている。このような信仰と、住民の死や疾病に対する考え方との関係を考えていくことは、生活に密着した医療システムを開発する手助けになる。

また亜熱帯気候であることから、入浴の習慣があまりなく、これが癩の伝染性疾患に関する有病率の高さと関係がありそうである。これは、東南アジア諸国と共通の問題と考えられる。

このように海外での活動を展開する際、宮古島の多面的な調査によって得られた知識、経験を役立たせ、また海外で得られた知識を国内活動に生かす事を考えている。それによってより幅広い医療協力、国際交流を行うことを目指していく方針である。

(指導：岡山大・医・公衆衛生・緒方正名教授)

11 日本医科大学東南アジア医学研究会の活動 久藤しおり (日本医大・6年)

本研究会の第1次調査は、当時の5年生を中心に、タイ国にて行われた。チェンマイ大学医学部の協力でタイ国の医療事情一般を集収した。第2次調査団は、山岳民族について、気候、飲料水、住居、便所等基本的なことであった。家族計画は避妊法を、経済問題はサラピー村の収入状況を、その他、村医、行政組織について調査した。第3, 4, 5次の調査は、専門家が調査するようになり、学生によるものは一時中断。第4次の皮膚疾患の調査について、今回発表を行った。第5次ではサラピー村の成人の体型を調査し、ラオス人に

近いことが分かった。第6次、7次、8次より、眼疾患、泌尿器疾患、血液等は、指導教官の専門に近いものを選んだ。第7次の医学生の意識調査は、36項目の質問表をもって行った。近視は、サラピー村より山岳民族の児童に多かった。第9次、10次も指導教官の専門領域中心に行った。第10次までは、毎年一冊の報告書を出版した。第6次よりは、専門的調査へとかたよった。また学生によるものも、各分野の予備的調査になっていたため、第11次より、チェンマイ大学医学部の共同調査の形をとり、ウイルス性疾患として、インフルエンザについて行った。インフルエンザについては、日本で流行する株の予測が可能となり、日本で作られるワクチンに、本研究会の株が利用されている。第14次よりは、タイ国の希望で、子供の皮膚疾患の調査、および治療を行い、今回発表した。またこの間、心理学テスト、思考過程調査、小学校の照明環境について、今回それぞれ発表された。1973年より、チェンマイ大学医学生の招待研修を1カ月にわたり行っている。ナース6名、研究者9名も招待研修した。

(指導：日本医大・皮膚科・宗像 醇教授)

12 山梨医科大学海外医学交流研究会の活動について

藤原 理恵、戸田 春男、佐藤 孝彦
(山梨医大・5年)
内田 直興 (山梨医大・4年)
星野 斉之 (山梨医大・6年)

山梨医大は開設6年目の新しい大学であり、〈世界、特にアジアに向けて開かれた大学〉、〈地域を愛し、病める人々と共に歩む大学〉を建学の精神としている。当研究会は、この精神へのひとつの応答として、開校2年目に発足した。

当会の第1の目的は、諸外国の医学教育・研究機関、および医療機関との交流である。しかし、日本および山梨県に関する理解が、海外に出る前の不可欠な前提であると考え、最初の2年間は国内活動(保健所・病院・市町村役場保健課・福祉事務所等の訪問)に力を注いできた。また、内外の医療事情について理解するためには、政治・経済・歴史・風土・宗教・習慣についての理解が重

要であると考え、これらについても文献を調べたり、専門家による講演会などを企画してきた。

同時に、会員各自が、自分自身の研究テーマを選ぶことになっている。現在は、1)日本の国際医療協力、2)アジアの医学教育および医療制度、3)寄生虫症、4)家族計画、5)東洋医学、の5項目となっている。

海外活動として、昨年は寄生虫学中島教授を団長として香港(香港大学、United Christian Hospital、Kai Tak 難民キャンプ等)、および台湾(陽明医学院、寄生虫防治会、台湾省家庭計画研究所、高雄医学院等)を訪れた。また、本年は、病理学小林助教授を団長として中華人民共和国(中国医学科学院、日中友好病院、中医学針灸研究所、上海第一医学院、日本国大使館等)を訪問した。

週1回、4時間にわたって行う定例会では、各テーマに沿った学習会、および討論を行っている。日常の継続的な活動を核として、内学の医学・医療、およびその環境である社会について理解を更に深めていきたいと望んでいる。

(指導：山梨医大・微生物・山田俊彦助教授)

13 フィリピンにおけるマラリア防疫体制の現状

戎井 力、小倉 裕司、岸 信之、
高見 康二、武田 卓、田中 知徳、
遠間 直人 (阪大・医)

今回の大阪大学熱帯感染症研究会のフィリピン研修は、①日本では実際の症例にあたることの少ない Typhoid fever 等の感染症の研修、②フィリピンにおけるマラリア防疫体制の現状の把握という2点を目的として行った。

第1点の感染症の研修は、国立サンラサロ病院で病棟での入院患者の管理について学んだ。同病院は、病棟を各疾病ごとに10の病棟に分けている。我々は各病棟において、各疾病の主要な症状を見学し、各病棟の医師から治療について説明を受けた。実際に見た臨床症状は、我々が学んでいた教科書的な記述と異なることが多いことを知った。また、同病院では、日本でルーティンとなっている検査や診断機械は用いられておらず、抗生剤の投与と輸液のみの治療には、日本の医療との違い

を痛感した。

第2点については、主に MES (Malaria Eradication Service) —マラリア撲滅を目的とした厚生省機関—の協力の下に行った。MES はマラリアのためのテクニシヤンの養成機関でもあるので、まず我々はここで Plasmodium の4種について、陽性陰性の判定、鑑別の方法を実習した後、MES の医師とテクニシヤンに同行して、マニラ近郊の Wawa にて、マラリアのフィールドサーベイを行った。同地では実際に採血、標本の作成、患者の診察も行った。

現在のマラリア対策は、かつての戸別の撲滅方式よりは、各村単位のプライマリケアに重点がおかれるようになっており、実際我々は、Wawa において、Rural Health Unit のドクターチームが月に1回の巡回医療サービスを行っているのに出会った。

また WHO を訪問し、松島博士より WHO の1982年にうち出された、World Epidemiological Situation に沿ったマラリア対策について説明を受ける機会を得た。さらに JICA の援助で設立された熱帯医学研究所 (RITM) を訪れ、金子所長から、日本のフィリピンへの技術協力の現状と、同研究所の臨床研究部の活動について説明を受けた。

(指導：阪大・微研・中林敏夫教授)

14 タイにおけるマラリア意識調査

篠原 有美, 酒井 秀樹

(岐阜大・医・5年)

我々岐阜大学医学部熱帯医療研究会は、海外に於ける熱帯病の現状を見つめ、その成果を日本で医療や海外協役に役立てたいと考え結成された。今回は熱帯病を通し、住民の意識や生活に少しでも多く触れようとアンケート調査を行った。

熱帯病としては、我々になじみの深いマラリアを選び、タイのチェンマイ北部の小さな農村で調査を行った。

結果として、マラリアは住民にとって依然恐ろしい病気であることが明らかになった。しかし、我々の調べた限りでは、タイのマラリア根絶活動はかなりの成果を上げ、統計的に見ても患者の発生率は、数十年前に比べ激減していることも事実

である。この点で住民の意識との間にギャップを感じた。

現在のマラリア対策についても、予防、診断、治療の面ではまだまだ多くの要望があげられている。一方で、医師不足や経済的問題などにより、住民が身近に医療を受ける体制が、十分整っていないのも事実である。タイではこれを補うためプライマリー・ヘルスケア体制の確立を急いでいる。マラリアの診断サービスなど、このプライマリー・ヘルスケアの分野に何か我々が彼らに協力しう点があるのではないかと考えた。

今回の調査では、実際にマラリアを検査して確かめたり、村で住民と直接コミュニケーションすることは、都合によりできなかった。このため今後、アンケートによる住民意識の変化や地域差を追及するとともに、採血による臨床検査など多目多面的、かつ細かい分析をも目指して活動を続けてゆきたいと考えている。

(指導：岐阜大・医・第一生理・竹内 宏教授)

15 スーダン・ゲジラ地区における医療事情見学報告

大菅 克知 (京府医大・6年)

小林 義典 (京府医大・5年)

1984年夏、我々は40°Cの岩砂漠の国スーダンのゲジラ地区を訪れた。ゲジラ地区とは、青・白ナイル川の合流する三角州のことで、ナイル川から引かれた運河によりゲジラ地区は大綿花栽培地帯と生まれ変わった。しかし運河の水は、住民に病気ももたらした。住血吸虫症は、その中でも最大の悩みである。ゲジラ地区では現在、住血吸虫症・マラリア・下痢を対象として、Blue Nile Health Project が進行中である。感染症以上に我々を驚ろかせたのは、住民の生活文化と深く関連した医療上の問題点であった。小児病棟で出会ったやせ細った、不機嫌な Kwashiorkor や Marasmus の子供たちの Malnutrition の原因は、食糧不足ではなく、長過ぎる母乳栄養と、炭水化物のみの伝統的な離乳食にあり、その背後には「動物蛋白は子を盗人にする」等の迷信が存在している。慣習と深くかかわるもう一つの問題は、女性の割礼である。エジプト起源と伝えられるこ

の慣習は、5-7歳の女子の外生殖器を切除し縫合するものである。性欲の減少が主な目的と言われているが、ショック尿路感染・尿閉・不妊・性生活の障害・分娩時の障害・精神的圧力など弊害は大きい。宗教と関連した医療上の問題に、シェフ (Shekh) と呼ばれる宗教的治療士の存在がある。シェフは現在に至るまで、スーダンにおける医療の中で重要な役割をになってきた。シェフの治療場はモスクと並んで村の中心にあり、彼らは村人から多大の尊敬を集めている。特に精神疾患に関しては、村人はシェフを通して宗教に救いを求めているのが現状である。精神科医達は、シェフの協力なくしては何もできない。現在スーダンでは、民間信仰、イスラム教という文化的基盤の上に立脚した、独自の地域精神医療の建設がはじまったところである。最後に今回の活動に大変お世話になったゲジラ大学の Dr. Osman, 大瀬貴光先生、吉田幸雄教授に感謝の意を表します。

(指導: 京府医大・医動物・松本芳嗣助手)

16 第6回アジア医学生会議, 4カ国におけるフィールドスタディ

廣田 直敷 (産業医大・医・5年)
木村 真美 (九州大・医・5年)
岩永 資隆 (福岡大・医・4年)

第6回アジア医学生会議は、1985年7月27日より8月2日までフィリピンのマニラ市において開催された。テーマは「人口問題における青年の役割—アジアの視点から」で、各国代表による発表、および討論が活発になされた。またフィリンにおける医療・社会の実情視察なども合わせて行った。

堅いことばかりでなく、それぞれのお国自慢の披露や、夜を徹しての率直な意見の交換も行われて、政治・宗教・言語の枠を越えた友情の輪が今年もまたひとつ広がった。

フィールドスタディは、例年会議終了後にタイおよび、インドにて行われてきたが、今年は更にフィリピン・台湾を加え、計4カ国で開かれた。

インドでは、マンガロール大学のウドッピー医科大学において、伝統医学アユルヴェーダの研修を行った。

タイではバンパ・インという土地に滞在しタイの地域医療の実態を見学した。

フィリピンでは、バイ・ラグナにおいて、国立フィリピン大学の Comprehensive Community Health Program に基づいて小学校の検診に加わり、小学生の栄養状態と学校の成績との相関関係について考察した。

台湾では中国医学とB型肝炎に関する研修を行い、特に、伝統的中国医学と西洋医学の関係について考察した。

おのおの、現地の医学生協力の下に、地域共同体と伝統医学の関連を考察し、日本ではお目にかかれないような疾患の診察に立ち会い、説明を受ける幸運にも恵まれた。

家庭訪問や学生との交歓会など、思い出は尽きない。

(指導: 阪大・歯・生化学・小池達也)

17 柏崎難民キャンプ報告

遠田 譲, 青木 薫

(新潟大・医・5年)

難民問題を考えるために、タイなどへ行くばかりでなく、身近な問題に取り組もうとこのリサーチを行った。キャンプは、1980年に柏崎市郊外の海沿いにカリタスジャパンにより設立され、定住先の未定なベトナム難民を引き受けている。設立当初は、運営も困難であったが、現在は軌道に乗っている。キャンプの人々は、我々の想像以上に明るく、開放的であった。規則や警備で施設化せず、各家庭毎の部屋を持ち、ほとんどの人々が工場等で働いていることにより、人間的でトラブルのない生活を送っていた。

柏崎は、一時滞在キャンプなので、人々は第三国か日本での定住を申請して、出て行かねばならない。第三国での受け入れは限界であり、人々は仕方なく日本定住を決心し始めた。柏崎でも一時滞在与並行して、定住問題に取り組み始め、数家族が、柏崎市内で定住生活を開始した。①経済的援助でなく、地域社会に溶け込むための、就職、住居、教育等の日常的な一般市民の協力を必要としている。②ベトナムが平和になったような報道が続いているが、彼らは政治難民であり母国に帰

れない。現在も南シナ海へと脱出するボートが、後を絶たない。これらの問題点を認識し、難民問題を遠い異国でなく、日本で解決して行かねばならない。そのために、日本における現在のシステム、問題点をよく勉強し、市民に伝えることが第一である。

我々が、難民の人々から学ぶ事ばかりのリサーチであった。一時的難民ブームが去り、これからの真の息の長い協力活動が望まれている。

(指導：新潟大・医・公衆衛生・須永 寛前教授)

18 台湾における寄生虫疾患に対する考察

佐藤 孝彦, 藤原 理恵, 戸田 春男

(山梨医大・5年)

星野 斉之 (山梨医大・6年)

内田 直興 (山梨医大・4年)

山梨医科大学海外医学交流研究会は、昭和59年、台湾において陽明医学院（台北市）、高雄医学院（高雄市）を訪問、60年は中華人民共和国において上海第一医学院（上海市）、首都医学院（北京市）を訪問し、医療従事者、学生との交流を行った。またテーマの1つである寄生虫感染症の調査、資料の収集を行った。以下の4疾患について報告する。

日本住血吸虫 (*Schistosoma japonicum*): 台湾における日本住血吸虫はヒト非感染性である。中間宿主貝である *Oncomelania* は、その種 (*Oncomelania hupensis formosana* と *O. h. chiuui*) および生息開始時期 (old location と new location) により、

セルカリア生産性、および動物感染性が異なる。この為家畜等への影響力も高く、大陸の貝との関係も含め、一連の研究が必要である。

広東住血線虫 (*Angiostrongylus cantonensis*): 台湾における中間宿主として、アフリカマイマイ、福寿貝 (*Ampullarium canaliculatus*) が知られている。高雄において、野生状態のアフリカマイマイ、福寿貝、ナメクジの感染の有無を調べ、感染幼虫を検出した。患者の報告は台湾南部中心であるが、中間宿主の分布から考え、全土に蔓延していると考えられる。細菌性髄膜炎として処理されている例も多い。

肝吸虫 (*Clonorchis sinensis*): 台湾における有病地は地域住民の出身地別分布と深いかわりを持っている。有病地は客家人居住地と一致している。これは歴史的経過の元に客家人が主に丘陵地に住むようになったこと、また淡水産の魚を生食する習慣があること等による。平野部中心に居住している閩南人には、このような習慣は無い。

肥大吸虫 (*Fasciolopsis buski*): 第1中間宿主として *Segmentina*, 第2中間宿主としてヒシ (*Trapanatus*) の実が知られている。収穫期には、ヒトもヒシの実を直接口にすることから有病地での感染率は非常に高い。ブタの糞便が、直接小川へ流れ込むことは、肥大吸虫のライフサイクル上の大きな要素である。しかし、川の水が汚染されると、ヒシが育たなくなり、感染率は低下する。

(指導：山梨医大・寄生虫・中島康雄教授、莊正國助手)

懇 話 会

1 元研修員からの発表

(和文抄録なし, 英文抄録 p. 332-337 参照)

2 JICA 研修コースの現状と将来

2a 神戸大学医学部 JICA 海外受託「医科学技術」研修コース

内山 三郎 (神戸大・医)

。(抄録なし)

2b 大阪大学微生物病研究所における JICA 集団研修, 微生物病研修コース

中林 敏夫 (阪大・微研)

当集団研修コースは1969年以来, 本年を以って17回目を迎えた。各年に5-8人程が1年間の研修を受け, 本年度を含め総数約110人に達している。地域別にはアジア地区が過半数で圧倒的に多く, 中南米, 中近東, アフリカの順となっている。

本コースの特徴は集団コースとして統轄しているものの, 実質は個別研修であり, 各研修員は研究所の各研究部門に配属され, 部門長以下の研究員による指導の元に, もっとも効果的な1年間の研修を受けることとなる。各研修員はそれぞれ違ったバックグラウンドを持ち, また研修目的も各員により異なっている。こうした事実を勘案して, 本コース独特の研修内容を持つに至ったものである。

もちろん, 集団コースとして, 例えば集団研修旅行や学会, シンポジウムなどへの集団的参加をはじめ, 当研究所で開催されるセミナー, 講習会などへの自由な参加が認められている。また, 旧研修員との交流, 指導も活発で, すでに一部の旧研修員は短期個別研修員として2-3カ月間再度の来日を果している。当研究所員による帰国研修員の現地指導も実施された。

今後も当研修コースを一層充実, 効果的なものとするため, JICA 研修コース委員会をはじめ, 全研究所教職員が積極的に努力する方針である。

2c 長崎大学熱帯医学研究所集団研修コース「熱帯医学研究」

内藤 達郎 (長崎大・熱帯医研)

標記コースは, 昭和58年度から特設集団研修コースとして開設された。その目的は, 熱帯地域にはびこる熱帯病, および各種感染症の予防さらには撲滅に資するために, 各研修員が, 当研究所専任教官の指導のもとに研究を実施し, その間に関連分野における現代科学に基づく基礎的知識の充実をはかり, その応用に必要な研究技術を習得させ, さらに帰国後自国で実地に活用するとともに, 関係者への知識・技術の伝達を行い得る能力を付与することにある。従って研修終了時に, 下記が達成されることを目標としている。1) 選択した疾患に対する基礎的および新知識の習得。2) 同疾患に関連した基礎的および新技法の習得。3) 上記知識および技法の自国での教育。4) 該疾患の調査研究の指導。5) 該疾患のコントロールの立案。6) 該疾患に関する基礎的研究を行う能力。

初年度はインドネシア・タイよりの各2名とグアテマラの1名が9月から6カ月の研修を受けたが, 59年度からは10月からの9カ月に延長し, ビルマ, インドネシア, コートジボアール, タンザニア, タイの各1名に対し研修を実施した。本コースも阪大・微研と同様に初期と集団旅行を除いては, 各研修員が選択した研究部門に配属され, 部門主任の責任の下に部門所属研究者の指導で研修を受けることとしている。その間には専門学会への出席, または他研究機関の見学も行われる。60年度については, 当研究所教授会としては関係学会の開催時期を勘案して昭和61年1月よりの9カ月を要望した。その結果, 関係機関了解のもとに昭和61年1月27日-9月30日の間, 当研究所での研修を行うこととなった。さらに61年度よりは常設研修コースへの移行を希望している。

3 ま と め

松村 武男, 内山 三郎 (神戸大・医)

総会第3日, 17時より第1会場で発展途上国からの, 元 JICA 医科学技術研修生の3医師をまじえた国際技術協力についての懇話会をもった。

ガーナ医科大学アシティ教授は, 日本での医科学技術研修をふりかえって, コミュニティヘルス研究が目的どおりにできたこと, 発展途上国の現状は依然として, 経済的貧困, 教育水準の低さ, 疾病の3点であることを報告した。医学・医療の技術協力として, 適正技術の導入や人的交流についての具体案が示された。

インドネシア, Dairi 地区の保健担当トガ・タンナン医師は, 彼の管轄する地域の保健水準はインドネシア国のレベルを下回るものであること, 現在5つの施策, すなわち, 1. 母子保健, 2. 栄養問題, 3. 家族計画, 4. 感染症, 5. 下痢症, をボランティア・ワーカーによって実施していることを

報告した。政府のバックアップと住民参加の必要性を強調した。ヘルスセンターの人材確保とその整備が当面の課題であることをのべた。

バングラデシュの予防医学担当官, ザキール医師は, 1981年日本での研修後, 自国での保健活動に従事したが, 現在はハワイ大学での公衆衛生研究に専念している。バングラデシュのプライマリ・ヘルスケアの現状とその問題点を報告した。

日本側からは, 神戸大学医科学技術研修コース(内山三郎講師), 大阪大学微生物病学研修コース(中林敏夫教授), 長崎大学熱帯医学研修コース(内藤達郎教授)の経過と現況報告があった。

最後に, 司会の松村武男本大会会長による総括がなされた。医学・医療の国際交流は, どのような理念で推進されるべきか, 交流のためのシステムをどのように作っていくかの2点に集約された。

総会最後のプログラムであったが, 国際交流の現状と展望をめぐる, 掘りさげた意見交換の場であった。

PROCEEDINGS OF XXVII ANNUAL MEETING OF
JAPANESE SOCIETY OF TROPICAL MEDICINE (3)

30 October-1 November 1985 Kobe

CONTENTS

- Special lecture: Dengue hemorrhagic fever: a critical appraisal of current hypotheses**
Dr. Leon Rosen
Science and technology and international exchange
M. Okamoto
- Symposium: Tropical medicine and molecular epidemiology**
Chaired by A. Ishii and K. Mifune
- Symposium: Tropical countries and Japanese medicine 1-4**
Chaired by K. Fukai and S. Tsuboi
5 Medical collaborations with tropical countries
Chaired by A. Fujioka and M. Tsuji
- Symposium: Infectious diseases of international travelers in the tropics
-present status of epidemiology and control**
Chaired by T. Nakabayashi and T. Aoki

(Appeared in Vol. 14, No. 2)

General presentation

(Appeared in Vol. 14, No. 3)

Student presentation

- 1 Illuminating circumstances in primary school in northern part of Thailand
Y. Taniguchi *et al.*
- 2 Hearing on the way of thinking of Chiang Mai medical students in Thailand
S. Saikawa *et al.*
- 3 Analysis of the images during the thinking process—Study of medical students of Japan and Thailand
R. Aoki *et al.*
- 4 On the feeling of Thai University students
K. Kanno and R. Aoki
- 5 The travel in the Philippines
K. Mashiba *et al.*
- 6 A visit at Leonard Wood Memorial Leprosy Research Laboratory
H. Tanaka
- 7 Epidemiological studies in Bay Laguna, the Philippines
K. Wakita *et al.*
- 8 On the activity of Sarawak Malaysia dialogue (SMD)
M. Inoue
- 9 Skin disease survey of children in northern part of Thailand
S. Kanno *et al.*
- 10 Survey of medical conditions in Miyako Island
A. Nohara and M. Henmi
- 11 Activities of the society for medical research in Southeast Asia of Nippon Medical School
S. Kudo
- 12 The activities of study group of international fellowship through medical science of Yamanashi Medical College
R. Fujiwara *et al.*
- 13 System of eradication of malariae in the Philippines
C. Ebisui *et al.*

- 14 Our research on attitudes toward malaria in Thailand A. Shinohara and H. Sakai
 15 Summer report on the medical situation in the Gezira area, Sudan, 1984
 K. Ohsuga and Y. Kobayashi
 16 The 6th Asian medical students' conference and field studies in four countries
 N. Hirota *et al.*
 17 Report on the Kasiwazaki refugee camp J. Touda and K. Aoki
 18 Considerations for the diseases caused by parasites in Formosa T. Sato *et al.*

**Social meeting: On the international exchange of technical cooperation
 in medicine**

Chaired by T. Matsumura and S. Uchiyama

- 1 Activities by the experticipants
 1a International exchange of technical cooperation in medicine G. A. Ashitey
 1b Integrated health services promote health status T. Tambunan
 1c Utilization pattern of a primary health care complex in a tropical country—Bangladesh
 A. M. Z. Hussain
 1d China and Japan cooperation promises the development of the Asian medicine
 S. Zeng
 2 Present situation and it's problem (No English abstract)
 2a Training course in medical science and technology S. Uchiyama
 2b Training course of microbial diseases T. Nakabayashi
 2c Training course in research for tropical medicine T. Naito
 3 Closing remarks T. Matsumura and S. Uchiyama

Student presentation

1 ILLUMINATING CIRCUMSTANCES IN PRIMARY SCHOOL IN NORTHERN PART OF THAILAND

YASUYUKI TANIGUCHI¹, SHIORI KUDO¹ AND MEISEN LEE²
6th¹ and 2nd² grade, Nippon Medical School

Our team had been checking skin diseases in primary schools at Chiang Mai, Thailand. Everytime it occurred to us that the room were so dark that we sometimes ever couldn't check skin conditions inside the room.

So we, the 18th research team (1984), checked the illuminating circumstances of 16 primary schools around Chiang Mai and compare them with Japanese one.

We found that the half of 16 schools we checked were lacking of light by measuring their ratio of window area to floor area, illumination index outside and inside, in addition the color of wall and ceiling, existence of blinds, shutters and skylight.

Those that should be improved are so follows: 1. to reserve the window area, 2. to paint wall and ceiling in bright color, 3. to use skylight as much as possible, 4. to improve shutters and 5. to consolidate illumination.

(Lead by Prof. A. Munakata)

2 HEARING ON THE WAY OF THINKING OF CHIANG MAI MEDICAL STUDENTS IN THAILAND

SHIGEKI SAIKAWA¹, ZENYA YAMAGISHI¹, TOSHIHIRO UTSUGI²
AND SHINYA TSUCHIDA²
4th¹ and 6th² grade, Fukui Medical School

In August 1985 we visited the Faculty of Medicine, Chiang Mai University in Thailand for student exchange and stayed at the dormitory during 2 weeks. We obtained informations on their life and the way of thinking through a questionnaire to 3, 4 and 5th year classes. Results were summarized as follows;

They come from all over the country but mainly from Bangkok and Chiang Mai Province. They work hard at lessons but "examination" is a big distress to them. They have adequate recognitions of their roles in health service after graduation. Of their various opinions on the medical system of Thailand, it is noteworthy to us that they affirm many defects of medical service in the rural areas. Additionally they are interested in the prosperity of Japanese industry, economy and also medical system, and half of them hope to visit Japan. On the other side some persons state that the Japanese are rather selfish among Asian peoples.

(Lead by Dr. N. Takada)

3 ANALYSIS OF THE IMAGES DURING THE THINKING PROCESS —STUDY OF MEDICAL STUDENTS OF JAPAN AND THAILAND—

RITSU AOKI AND KOHJI KANNO
4th grade, Nippon Medical School

Images used during thinking processes were studied by 41 subjects of the medical students of Chiang Mai University of Thailand. We turned our attention to the difference of culture between Thailand and Japan, and compared the data with the result which the first Department of Physiology of Nippon Medical School had surveyed in Japan.

Questionnaire reports on 39 problem of thinking processes were of 4 types; logical, creative, episodic and sensitive. Images were classified into verbal and non-verbal; and into 3 types—visual, auditory and of other senses. The principal component analysis of the images revealed 4 components; the first component named “visual factor”, the second “sensitive thought”, the third “remembering”, the fourth “thought”.

The major findings were as follows: 1) On questionnaire, 67% of Japanese subjects used “visual image” chiefly, and 33% used “visual and auditorial image”, while 46% of Thai used “visual image” and 41% used “visual and auditorial image” chiefly. 2) Some Thai used sensitive image only, while Japanese never failed to use it with other images. 3) Both Thai and Japanese used verbal image in the logical problems. While as for the sensitive problems, both took the “visual and auditorial” type. But in the sense of verbal-nonverbal, most Thai took both “verbal and auditorial” type. 4) Among the 39 problems of thinking, the sensitive problems revealed differences in culture and environment between Thailand and Japan.

(Lead by Dr. Y. Shinagawa)

4 ON THE FEELING OF THAI UNIVERSITY STUDENTS

KOHJI KANNO AND RITSU AOKI
4th grade, Nippon Medical School

By grasping the psychological formation of Thai people at the level of feeling, we aimed to understand all the people concerned with medicine including patients in order to make public health approach easier in the future. By means of Color Choice Test (C. C. T.) developed by the Department of Psychology of Nippon Medical School, we have compared the data of Thai University students with that of Japanese (Jap. J. Health and Human Ecology, 51 (1), 20–29).

This time, although they are of positive feeling words, we chose different color images come from “father” and “mother”, and tried to make sure of the correctness of the results of C. C. T. by corresponding them to the religious life attaching to Thai common people.

From the standpoint of their unique mixture of three religions—Buddhism, Brahmanism and local belief, and their deep effects to Thai people’s life, the various color images correlating to “father” and “mother” can be understood.

(Lead by Dr. Y. Maruyama)

5 THE TRAVEL IN THE PHILIPPINES

KOUCI MASHIBA¹, TOMOKO NISHIMURA² AND TAEKO FUKUDA³

4th grade, Fujita-Gakuen University School of Medicine¹ and
5th² and 4th³ grade, Hyogo College of Medicine

It was the 7th trial that Japanese medical students studied at San Lazaro Hospital in the Philippines. The purpose of our trip was to see the infectious diseases directly and to know the current state of medical treatment in the Philippines. We could observe how to diagnose and care the symptom of rabies, tetanus, malaria, and cholera that could not be seen in Japan. Through studying about the problems of medical treatment in the Philippines, we deeply think over what we need in order to realize the true medical treatment not only in the Philippines but also in Japan.

(Lead by Dr. Y. Yanagase)

6 A VISIT AT THE LEONARD WOOD MEMORIAL LEPROSY RESEARCH LABORATORY

HIROYUKI TANAKA

3rd grade, Hyogo College of Medicine

During a stay in the Philippines, we went over the Cebu Island, visiting to the Leonard Wood Memorial Leprosy Research Laboratory (L.W.M.L.R.L.) on August, 20 in 1985.

The L.W.M.L.R.L. established by the supports from foreign countries discharged the high function of each institution, being substantially filled with the Philippine staffs. Therefore I thought this was a true picture of the supports to foreign countries.

We have annually visited to the Philippines since 1979, especially to San Lazaro Hospital in Manila. This year we finished the seventh trial to study in the country. Year by year, our investigations have become replete in content. In Hyogo College of Medicine the Tropical Medicine Society has been lately established. We want to develop relationship among Fujita-Gakuen Health University School of Medicine, Nara Medical University and us from now on.

(Lead by Dr. Y. Yanagase)

7 EPIDEMIOLOGICAL STUDIES IN BAY LAGUNA, THE PHILIPPINES

KAZUYUKI WAKITA, HIROYUKI NAMURA, AKIHISA KODAMA,
AJU KAMEDA, YUMIKO SUZUKI, SHOTARO TATSUMI
AND KAZUO TSUJIMOTO

Kobe University School of Medicine

Nutritional surveys have been conducted in Bay Laguna, about 70 km southeast of Manila,

the Philippines for these three years.

Body weight, height, chest and head circumferences, right upper arm circumference and skin-fold thickness measurements were studied in 0-6 years old children. There are no comparable data in the Philippines. Compared with the Japanese data, the growth of these children seemed retarded, especially of the children aged more than 2 years old. About 1/2 to 2/3 of the caloric intake calculated in 20 households derived from the rice diet. The caloric intake and the volume of the animal protein intake were low.

(Lead by Dr. S. Tsuboi)

8 ON THE ACTIVITY OF SARAWAK MALAYSIA DIALOGUE (SMD)

MASAMI INOUE

3rd grade, Kobe University School of Medicine

We performed an environmental survey of 'Longhouse' in Iban (Sarawak, Malaysia), and especially a survey of mite fauna in the dust collected from these houses.

It was suggested that the change of living environment accompanied by the modernization of the 'Longhouse', for example, increase in number of mites caused by spreading vinyl sheet on the floor, did not result in healthy and comfortable environment of the residents.

(Lead by Prof. T. Matsumura)

9 SKIN DISEASE SURVEY OF CHILDREN IN NORTHERN PART OF THAILAND

SHIGETO KANNO, SHIORI KUDO AND YASUYUKI TANIGUCHI

6th grade, Nippon Medical School

This survey is made once a year in August from 1980. We examined children of public and private schools in Chiang Mai City and villages around the city including leprosy villages. Statistically, common skin disorders of children in northern part of Thailand were 1. pediculosis capitis, 2. toe nail deformity, 3. angular stomatitis, 4. spotted leucoderma, 5. impetigo and 6. tinea versicolor. In these diseases, pediculosis capitis, toe nail deformity and angular stomatitis were seen more frequent in urban area than in the city. All these diseases were seen more frequent in Thailand than in Japan. Leprosy that were checked was 10 cases during past 5 years.

Although the measure for controlling leprosy in Thailand has been successful, it seems to be an important problem still now in this country that the new cases of children can be found among the pupils.

(Lead by Prof. A. Munakata)

10 SURVEY OF MEDICAL CONDITIONS IN MIYAKO ISLAND

ASAKO NOHARA¹ AND MUTSUMI HENMI²

3rd grade¹ and 2nd grade², Okayama University School of Medicine

We, the Society for the Traditional Medicine in Asia, have conducted surveys of traditional medicine in foreign countries every year. However, we also do some activities inside Japan while visiting other countries. For example we studied the medical conditions in Miyako Island. We looked at medical care from the religious, cultural, and daily life points of view in an effort to aid in the development of a medical system oriented toward the people of the Island. We have already analyzed the former survey and have made some approach of looking into medicine in the cultural aspect.

(Lead by Prof. M. Ogata)

11 ACTIVITIES OF THE SOCIETY FOR MEDICAL RESEARCH IN SOUTHEAST ASIA OF NIPPON MEDICAL SCHOOL

SHIORI KUDO

6th grade, Nippon Medical School

For 10 years from 1966, the researches were carried out by the leadership of medical students on infectious diseases, problem of nutrition, population problem, parasit, dermatoses, urinary stone, eye diseases, birth control problem, Thai student's disposition etc. The results were reported every year by our own publications. From 1977 to 1985, researches about dermatoses including treatment for them were conducted. Some influenza virus strain isolated in Thailand were introduced in influenza vaccine of Japan by the result of the viral study.

Psychological test and the study of the brain laterality function on medical and nursing students of Chiang Mai University were conducted from 1983 through 1985.

For past 13 years, our Society has invited 32 medical students, 6 nurses and 9 medical staffs from Chiang Mai University, medical and nursing schools.

(Lead by Prof. A. Munakata)

12 THE ACTIVITIES OF STUDY GROUP OF INTERNATIONAL FELLOWSHIP THROUGH MEDICAL SCIENCE OF YAMANASHI MEDICAL COLLEGE

RIE FUJIWARA, HARUO TODA, NAOKI UCHIDA,
HITOSHI HOSHINO AND TAKAHIKO SATO

Study Group of International Fellowship through Medical Science,
Yamanashi Medical College

Our college was established in 1980. "The college being open to the world, especially to Asia" and "The college loving the surrounding area and living together with people suffering from disease" are our spirits. Responding to these spirits, the activity of our study group was started in 1982.

We make it rule that the each one chooses one's theme. The themes at present are following; 1) Over sea communication through medicine, 2) Medical education and the system of medical care in Asia, 3) Parasitic disease, 4) Family planning, 5) Chinese medicine.

As the over sea activities, we visited Hong-Kong and the Republic of China (the leader: Prof. Nakajima of Parasitology) last year. And this year, we visited the People's Republic of China (the leader: Ass. Prof. Kobayashi of Pathology).

We want to deepen our understandings about medical science and medical care, and the social circumstance home and foreign by continuous activities.

(Lead by Dr. T. Yamada)

13 SYSTEM OF ERADICATION OF MALARIAE IN THE PHILIPPINES

CHIKARA EBISUI, HIROSHI OGURA, NOBUYUKI KISHI, KOJI TAKAMI,
TAKASHI TAKEDA, SATONORI TANAKA AND NAOTO TOMA
Osaka University, The Group for Tropical Infectious Diseases

(Abstract not received in time)

14 OUR RESEARCH ON ATTITUDES TOWARD MALARIA IN THAILAND

ARIYOSHI SHINOHARA AND HIDEKI SAKAI
Gifu University School of Medicine

We established the Research Club of Tropical Medicine in order to learn about the present conditions of tropical diseases and to apply this knowledge to Japanese medical care as well as to international cooperation. We held a questionnaire survey in an effort to study the lives and

attitudes toward tropical diseases of the people there. The disease we chose was malaria, and our survey was conducted in a small village in northern Chaing Mai Province.

Our studies showed that malaria is still a very much feared disease. Efforts to exterminate malaria have made much progress, and statistically speaking, the number of malaria cases has declined dramatically from several decades ago. We felt there was a gap here between the facts and the the people's attitudes.

We found that the people still have requests concerning prevention, diagnosis, and treatment measures against malaria that the government should take. It is a fact that the people are unable to receive adequate treatment due to the deficiency of doctors and to financial difficulties. Thailand has developed a primary health care system to alleviate this problem. We felt that in such areas of primary health care as the malaria diagnosis service there is some way for us to cooperate.

Since we were unable to communicate with the villagers, from next time we would like to study changes in attitudes, regional differences, as well as extensive tests with blood smears.

(Lead by Dr. H. Takeuchi)

15 SUMMER REPORT ON THE MEDICAL SITUATION IN THE GEZIRA AREA, SUDAN, 1984

KATSUNORI OHSUGA AND YOSHIFUMI KOBAYASHI

Kyoto Prefectural University of Medicine

In the summer of 1984, we visited the Gezira area of Sudan, which is the large flat plain between the 2 great Niles. With the irrigation of the desert, the Gezira area has become a fertile agricultural area, mainly producing cotton. But the water has brought several diseases to the residents. In the Gezira area, the Blue Nile Health Project has been working for several years to control schistosomiasis, malaria and diarrhea. What was surprising to us were the medical problems caused by the cultural customs of the local people. The malnutrition is not caused by a lack of food, but an incorrect way of feeding (e.g. long-term breast feeding, sometimes lasting for 2 years). There is a local superstition which states, "If you give animal protein to children, they will become thieves". In the obstetric field, female circumcision is a major problem. Many complications result from this, such as shock, sterility, urinary tract infection, disturbance in coitus and labor. In Sudan, religious healers (Shekh) still play an important role, especially in psychiatric field. A Shekh lives next to a mosque, and is worshiped by the local people. Some of the methods that a Shekh uses as therapy include flogging and giving out holy water which contains pieces of the Koran. The Shekhs have a great deal of influence over the people, and there is nothing psychiatrists can do without their cooperation. Medical work cannot be done without regard to custom, superstition and religion in Sudan.

(Lead by Dr. Y. Matsumoto)

16 THE 6TH ASIAN MEDICAL STUDENTS' CONFERENCE AND FIELD STUDIES IN FOUR COUNTRIES

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The 6th Asian Medical Students' Conference (the 6th AMSC) was held in Manila, the Philippines from 27th July to 2nd August, 1985. The theme was 'The Role of Youth in Population Control; Asian Viewpoints'. All the delegates took an active part in the discussions, and the presentations were beneficial to all the participants. Also, we tried our best not only during the official programs but at the 'Cultural Night' and the individual intensive discussions that lasted far into the night. These offered us chances for developing deeper interpersonal friendships in spite of the difference of political, religious and linguistic backgrounds.

We used to hold Field Study Programs after the conference only in Thailand and India, but this year we added 2 other countries; the Philippines and Taiwan. In each country we had chances to consider the relations between the communities and traditional medicine, and to observe the examinations of patients who suffered from diseases seldom met with in Japan.

Our memories of home visiting and cultural exchanges are still vivid, and we are sure they will remain with all the delegates for a long time.

(Lead by Dr. T. Koike)

17 REPORT ON THE KASIWAZAKI REFUGEE CAMP

JOE TOUDA AND KAORU AOKI
Niigata University School of Medicine

In May 1984, we had a chance to visit "Catholic Umi-no-Ie", a refugee camp in Kasiwazaki City in Niigata Prefecture.

This refugee camp was founded in 1980 and today it houses about 50 refugees. The priest who took care of them made no strict rule. The only thing he promised with each of them is never to make trouble for one another. He spared much time for educating neighbors to understand refugees to give them a chance to work and study.

Everyone who can work in the camp has a job and earns his living by himself. Children go to primary school (even though some of them are aged over 12) and the aged also study Japanese at night keenly. It is a good base for a peaceful life there to live as a human being, probably they are not fully satisfied.

In the first half of this year 317 people fled from the Indochinese peninsula to Japan. Nowadays it is difficult to move to third country and the refugees are forced to settle down in Japan. This problem is severe and needs more cooperation and more mutual understanding than only receiving them into camp does.

We also studied the diseases and the health conditions. Some diseases are uncommon here in Japan. We easily change our interest according to the mass media. Remember the refugee problem still exists in our country. We have gradually noticed in our activities that good reference materials are scattered around us which inform us of something from an international point of view.

(Lead by Dr. H. Sunaga)

18 CONSIDERATIONS FOR THE DISEASES CAUSED BY PARASITES IN FORMOSA

TAKAHIKO SATO, RIE FUJIWARA, HARUO TODA,
HITOSHI HOSHINO AND NAOKI UCHIDA

Study Group for International Fellowship through Medical Science,
Yamanashi Medical College

Since 1984, we have made research in Formosa and People's Republic of China. Visiting some Medical Universities, we made a communication and discussion with medical staffs and students in both countries. In parasitic sight, we could see some parasites and their polluted areas, which we can't see in Japan, in the point of host-parasite relationship.

1) *Schistosomiasis japonicum* (S. j.): S. j. in Formosa is not infective to human. But the differences of the species of the intermediate host and the variation of old-new locations of it make some differences in producing cercaria and infecting to animals.

2) *Angiostrongylus cantonensis* (A. c.): In Formosa, there are *Achatina fulica* and *Ampullarium canaricultus* as intermediate hosts of A. c. Many patients are reported in the southern part of Formosa. But this parasite can be considered to spread all over Formosa under the consideration of the spread of intermediate host. Some diseases which this parasite causes mistake for the bacterial meningitis.

3) *Clonorchis sinensis* (C. s.): The polluted areas of C. s. have deep relationship with the coming place of the inhabitants from China continent. Hakka people, as we call, living in the hill areas eat raw meat of flesh water fish, on the other hand, Binnan people living in the plain areas never eat one.

4) *Fasciolopsis buski*: In the polluted area, people has a custom to eat raw fruit of *Trapa natus*. There are pig-snail-natus-pig cycle of this parasite. But *Trapa natus* can't grow under the condition of dirty water which is caused by feces of pigs. It's a paradoxical.

(Lead by Dr. Y. Nakajima and Dr. M. So)

Social meeting

On the international exchange of technical cooperation in medicine

1 ACTIVITIES BY THE EXPERTICIPANTS

1a INTERNATIONAL EXCHANGE OF TECHNICAL COOPERATION IN MEDICINE

G. A. ASHITEY

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Ghana Medical School, Accra, Ghana

In 1978/79 I was one of 4 participants who took the training course in Medical Science and Technology in Kobe University. Before coming to Japan I was a lecturer in the Department of Community Health at the University of Ghana Medical School. I am still teaching in the school. My study in Japan, I believe was to make me more capable to help solve some of the health problems of my country as a Community Physician. The course content was so flexible that each individual had ample time to pursue personal interests. I took the opportunities to study the health system of Japan to find out if there were any lessons that we in developing countries can learn from the rapid improvement in the health status of the population which has been achieved by Japan in a period of 2 decades after world war II.

I found out that good basic education, discipline and work ethics of Japanese culture, good planning and management based on available health statistics, local initiative of your prefectural system of government, were some of the secrets which led to your rapid economic recovery and the improvement in the health of your people. One cannot read this in books, one has to come to Japan to see and feel it, and I am very grateful for this education. Such lessons must be of interest for developing countries which are still plagued by the triad of poverty-ignorance-disease.

Since my training I have had the opportunity to reflect on my 10 months experience in Japan and I have worked with some of the experts sent by JICA to my country. From these experiences I would like to comment on 3 broad areas of Technical Cooperation in Medicine.

1. Transfer of appropriate technology.
Priority areas being infectious and parasitic disease control and improvement of nutrition.
2. Exchange of medical scientists.
3. Collaborative research between Japanese Medical Institutions and Medical Schools or Institutes in developing countries.

On transfer of appropriate technology I have little to add to the discussions that we had yesterday, except again to underscore the point that what many developing countries need are basic knowledge and skills on which to build their infrastructure. I know that it is easier for JICA to provide electron microscopes than to provide simple hand pumps for water supply or simple generators for electricity, but, to be frank, sometimes we fail to achieve our goals by not considering carefully the conditions that exist in our countries. On the second area of exchange

of scientists, I would like to be frank and say that what is required is true exchange. There are two categories of scientists—the learner and the experts. There are Japanese learner and Japanese experts. There are also experts and learner from developing countries. It seems to me that sometimes this differentiation is not made and this leads to misunderstanding and frustration. Each category of scientist should be accorded the right status and privileges. An example here is the accreditation of medical practitioners to work in the host countries. Although Japanese experts are sometimes allowed to practice in the host countries, such privileges are not extended to foreign doctors who come to Japan. I know that there are legal requirements, but as we get to know each other better, we should be in a position to formulate policies towards such accreditation.

Lastly, collaborate research between institutions. I think now we have institutions in some developing countries; Noguchi in Ghana, KEMRI in Kenya, and medical schools in most countries. In my opinion Japanese institutions should foster close links with such institutions so that our scientists can work together and know each other, thereby improve international peace and friendship as we all work towards the WHO's goal for the year 2,000, which is *Health for ALL*.

1b INTEGRATED HEALTH SERVICES PROMOTE HEALTH STATUS

TOGA TAMBUNAN

Dairi Regency Health Services, Indonesia

Until now, Infant Mortality Rate (I.M.R.) and mortality rate for the children under 5 years of age is still high in Indonesia and the status exist in the second group together with Burma, Iran, Tunisia, Peru, South Africa, Brazilia, Kenya and China.

In 1983, I.M.R. in Indonesia is 96, and mortality rate for children under 5 years of age is 40. The causes of their death are malnutrition, respiratory infection (pneumonia), diarrhoe, tetanus and measles. Beginning from this data, for prevention, curing and rehabilitation of health, our government force to decreased the I.M.R. from 96 to 72–74 in the end of the 4th five years development plan and then to decreased it again to 45 in the Year 2000.

The problem is the data from each province. For example, North Sumatra we don't have. The life expectancy in 1981 was 51–52 years in women and 48–49 in men.

Nutritional status shows that 33% of children under 5 years of age suffered from protein calory malnutrition, and about 3% get severe malnutrition, while 30–70% of pregnant women get malnutrition and about 7% suffered from protein calory malnutrition.

But again, this is the national health data.

If we pay attention to the house hold survey by Ministry of Health in 1980, we can see that the causes of death in children under 5 years of age and babies are still infectious diseases (diarrhoe, acute respiratory infection, tetanus, other neonatal infection, meningitis, parasitic infection).

From the above problems we can notice that the causes of these problems are the low immunity and lower nutrition due to the following reasons:

1. The community's knowledge of health is still low. From the house hold survey, we found that among the sick people, 44% are searching for help from health institution, 26% help

- themselves and 26% do not search help and the others do not know.
2. Parents still do not pay attention to their children due to their socio-economic condition, beside that the interval time between 2 labors is still too short.
 3. Knowledge of using the environment for themselves is still low. We can see many rural area not yet used and only 18% of rural people get good water supply and only about 20% have latrine.
 4. Awareness of the people is still very low in using health institution.

Problem solution

We have decided that if we want to achieve our health status we must have participation of the community and we must use their knowledge, material and the environment to fight against diseases and their breeding places.

For this purpose our government had made joint program between the Ministry of Internal Affair, Ministry of Health and National Family Planning Board to make Integrated Health Services Program which we called it in Indonesia, Pos Pelayanan Terpadu (Pos Yandu). Pos Yandu, is owned by the kampong people and operated by the rural volunteer health workers group, who serve the community in family planning, mother and child's health, nutrition, immunization and prevention and fight of diarrhoe.

Pos Yandu exist under the control of Institutional for Kampong's Community Defence (we called it in Indonesia L.K.M.D.) and chief kampong and under technical guidance from health centre's staff.

The volunteer health workers were taken from women's society, youth and the key persons, and each group consists of 15 persons who were trained by the health center's provider at least in the above 5 problems.

We hope that the volunteer will be able to do the following works:

1. *Mother and child section*
The worker must be able to record pregnant women in their kampong and propose them to examine at the health centre. The worker must be able to record post-partum mothers and to stimulate breast feeding for 2 years and give advice about what kind of food will be good for health. The worker must be able to record babies and children under 5 years of age in order to prepare for immunization.
2. *Nutritional section*
The worker must be able to give information about what kind of food will be good for babies, pregnant women and children under 5 years of age. The worker must be able to stimulate community to make *Nutritional Garden* by the technical guidance of Agricultural Department. The worker must be able to demonstrate good foods that are easy and cheap for children.
3. *Family planning section*
The worker must be able to record partners who can manage labors, current user of the type of contraceptives they used. The worker must be able to be motivator for family planning in their kampongs. The worker must be able to give condoms to the user and and second cycle of pills.
4. *Immunization section*
The worker must be able to give information about immunization in prevention of some infectious diseases. The worker must be able to record pregnant women, post partum women babies and children under 5 years of age who had immunized.

5. *Prevention of diarrhoe section*

The worker must be able to give information about symptoms of diarrhoe and its danger and how to fight against it. The worker must be able to popularize sugar-salt solution.

Conclusion

In our plan, all the kampong should have at least one Pos Yandu for each kampong, thereby our health status will be better in the future. Anyhow, the national health data is not enough. Provincial data is important because there is a variation in each region. Since the condition of malnutrition is still high, extra feeding is needed for them.

The important things, of course, is the participation of community and other governmental apparatus. They should work hand in hand with the Ministry of Health in order to increase the health status.

Last but not least, if we want to increase the health status, the good personnel and complete facility of health centers should not be neglected.

1c UTILIZATION PATTERN OF A PRIMARY HEALTH CARE COMPLEX IN A TROPICAL COUNTRY-BANGLADESH

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Health problems vary from country to country and even from one geographical region to another in the same country. Information which helps solve these problems must be for the same reason peculiar to the local situation. Unfortunately due to lack of indigenous data the developing countries try to solve the problems by utilizing knowledge which have had been earned from a different setting often foreign to the local atmosphere.

To address some of these problems and generate local information this study was undertaken.

Bangladesh is a tropical country 500 feet above the sea level, situated in between India and Burma. Its mean temperature is about 70 to 80°F with 70 to 80% humidity and about 200 inches of rain fall per annum.

Literacy rate is very low, only 28 per cent. Annual per capita income is only US dollar 130. Living expenditure is, however, low commensurately and so is the standard of living which is, however, slightly skewed. Agriculture is the main occupation.

Bangladesh has a population of about 90 million and its area is about 55,105 square miles. Male to female ratio is 49 to 51. About 16% of the population is under 15 years of age with a dependency ratio of 105 to 100. These facts have important bearings when we analyze the utilization rate of a hospital, the primary health care complex in a rural area of Bangladesh.

The whole country has been divided into more than 415 Upa-Zilla; the primary units of governmental administration. Each Upa-Zilla has 250,000 population for whom a hospital with 31 beds, M.C.H. clinic, outdoor dispensary, a small laboratory and a domiciliary service component are available. Each hospital or health complex, to be more specific, has 8 to 10 graduate physicians, 5 registered nurses, 2 laboratory technicians, and about 100 to 120 domiciliary health

and family planning service providers.

The present study was done in the outdoor dispensary of one of the prototype health complexes, in the month of January and February in 1983. It includes 500 study subjects who were selected on the first available basis with a 100% response rate. Besides the data obtained in the current study service utilization rates and disease patterns of some of the previous years were also appended. Data were collected by using a structured questionnaire, interviewed by an independent observer; a graduate physician.

Utilization rate was found to be skewed. Male and adult utilization rates were higher disproportionately. Occupation and educational levels of the utilizers reflect general population trends. However, more well to do people were found to utilize the services.

Skin, gastro-intestinal and respiratory tract infections had been found to be the most prevalent which speak of the lack of sanitary environment in the rural areas.

Utilization rate depends mainly on the distance that the utilizers have to cover to obtain the service and availability of free medicine. Over all subjective rating of the quality of the services provided was found to be satisfactory.

People seemed to have poor knowledge of the preventive services and even when they were found to have had sufficient knowledge they were usually apathetic to these services.

The utilization pattern and the disease pattern were similar to other published data from India and many other African countries.

The authors feel that other domiciliary interview schedule may be complementary to the present study.

For interested readers data in the appendix can be useful as denominators for estimating over all population based rates, ratios and proportions.

1d CHINA AND JAPAN COOPERATION PROMISES THE DEVELOPMENT OF THE ASIAN MEDICINE

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China and Japan are very close neighbours with a history of over 2000 years of cultural exchanges. In recent years the friendly visits between the two countries and particularly the exchanges in the field of medicine have been increasing day by day.

As a member of Japan International Cooperation Agency, I, highly honoured, came to Kobe University School of Medicine. Under the supervision of Professor Shigeaki Baba in the Second Department of Internal Medicine, I began the research of clinical endocrinology. During the two years there I learned some good and necessary methods of conducting research of endocrinology. For instance, by means of cultured lymphocytes, radioimmuno-assay, radioreceptor assay, I conducted the research of insulin and insulin receptor. With one of the researches that I did while in Kobe University and a paper about it I will apply to Kobe University School of Medicine for my doctorate. The title of the paper is "Effects of Sulfonylureas and Clofibrate on Insulin Receptors in Cultured Human Lymphocytes". This study demonstrates an in-vitro effect of

sulfonylureas to increase the number of cell surface insulin receptors. In contrast to sulfonylureas, clofibrate increases the insulin receptor's affinity rather than the number of receptors. This finding may explain the well-known hypoglycemic effect of non-insulin dependent diabetes mellitus.

After I returned to China in January, 1985, I began to make a plan for the study of human red cell insulin receptor, aiming at researching the effective factors influencing human red cell insulin receptor, especially the influence of Chinese traditional medicine towards insulin receptor. I have been and will be working hard to contribute my bit to the cure of diabetes mellitus without insulin.

2 PRESENT SITUATION AND IT'S PROBLEM (No English Abstract)

2a TRAINING COURSE IN MEDICAL SCIENCE AND TECHNOLOGY

SABURO UCHIYAMA

Kobe University School of Medicine

2b TRAINING COURSE OF MICROBIAL DISEASES

TOSHIO NAKABAYASHI

Research Institute for Microbial Diseases, Osaka University

2c TRAINING COURSE IN RESEARCH FOR TROPICAL MEDICINE

TATSURO NAITO

Institute for Tropical Medicine, Nagasaki University

3 CLOSING REMARKS

TAKEO MATSUMURA AND SABURO UCHIYAMA

Kobe University School of Medicine

On the 3rd day of the Annual Meeting of Japanese Society of Tropical Medicine, we had the social meeting on international technical cooperation with 3 medical doctors coming from developing countries. Prof. G. A. Ashitey reported on his experience at Kobe University School of Medicine as a JICA participants and on present health situation in Ghana. Then, Dr. Toga Tambunan from Indonesia and Dr. H. Zakir from Bangladesh also reported the health conditions of their own countries and actual practice in community health developments.

From Japan side, we had 3 reports as follows: Medical Science and Technology course in Kobe University by Dr. S. Uchiyama, and course of Microbiological Diseases in Osaka University

by Prof. T. Nakabayashi, and the Tropical Medicine course in Nagasaki University by Prof. T. Naito.

Finally, Prof. T. Matsumura, president of this annual meeting, had summarized that we should try to build up the ideas for international exchange program and to make up exchange system between Japan and developing countries.

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CONTENTS

Original article

- Ohsugi, Y., Maeda, K., Yoshiki, T., Tsubura, A. and Ohyama, A.
Pathological Study of Mouse Brain Infected with Wild Type Strains of
Dengue Virus Type 2 (in Japanese)..... 261-265
- Shimada, M., Hirata, M., Sato, K., Wambayi, E., Ouma, J. H. and Aoki, Y.
Egg Count in Urine to Determine the Intensity of *Schistosoma*
haematobium Infection 267-272
- Ufomadu, G. O., Braide, E. I., Edejindu, G. O. C., Tada, I., Takahashi, H. and Akoh, J. I.
Acid Phosphatase Staining-patterns in the Microfilariae of *Onchocerca volvulus*
from the Guinea Savanna of the Jos Plateau, Nigeria 273-283
- Takaoka, H.
Observations on the Multiple Gonotrophic Cycles Completed by *Simulium*
takahasii (Diptera: Simuliidae) in the Laboratory..... 285-293
- Shiwaku, K., Takahashi, H., Nwoke, B. E. B., Onwuliri, C. O. E. and Ufomadu, G. O.
Parasitological Surveys in the Jos Plateau, Nigeria 295-302
- Ebisawa, I., Ohara, H. and Tani, S.
Atrial Flutter in a Case of Mixed *Plasmodium vivax* and *P. falciparum* Infection 303-306
- Proceedings of XXVII Annual Meetings of Japanese Society of Tropical
Medicine (3)**
- Contents 321-322
- Student presentation 323-331
- Social meeting 332-338

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