SANITATION AND CULTURE-II: BEHAVIOURAL ASPECTS OF DISPOSAL OF EXCRETA IN A RURAL W. BENGAL REGION*

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Summary of the First Part of the Paper

Purely technological emphasis in environmental sanitation has lead to the neglect of whole spectrum of cultural and behavioural interventions in man-environment relationship. Specific health related outcomes (or specific disease related effects) in rural communities are the sum total of all positive and negative consequences emerging out of traditional cultures or out of planned health programmes.

The field study was conducted in Bandipur *anchal* of Hooghly district W. Bengal in 1968-70. A population from twelve contiguous villages was chosen from which a random sample of 100 households (750 persons) was selected for epidemiological survey by a team. A subsample of 50 households was drawn for detailed anthropological studies.

A large number of sanitation and personal hygiene parameters were reported in the cultural context. An overall sanitation index was computed, based on 15 indicators. Sanitation score shows moderate to strong association with other social variables but it does not show clear cut relationship with health status indicators. People are more likely to perceive cultural values and quality associated with sanitary innovations than its health implications (and quality). Epidemiologically useful components of the local culture can be built into sanitation technology and programmes. The second part of the paper examines this socio-epidemiological strategy with regard to hookworm infection in relation to habits and patterns of disposal of excreta.

Sequence of Defecation Behavior**

The people defecate at short distances from their homes. About 95% of the subjects choose their defecation spot within a walking distance of three minutes from their homes. The males on the average go a longer distance than the females. About 72% of them select a socially recognised defecation ground. They walk around within the defecation ground for an average of 1.4 minutes to reach a suitable spot for squatting. About 69% of the subjects choose a maximally polluted area. They squat for about 3 minutes on an average. About 17% complete defecation within one minute and 71.5% within four minutes. Time lapse between defecation and entering a pond for ablution is less than one minute for 41% of the subjects, less than four minutes for 83% and less than five minutes for 90%. Epidemiological significance of these various durations is discussed elsewhere (Kochar 1975; 1976).

Norms of Defecation Behaviour

The ritual norms of daily routine of a

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Hindu household emphasize the importance of early socialization of defecation habits. Ablution in pond is done by rubbing the peri-anal skin with water in squatting posture. This is followed by rubbing the hands with soil as a purificatory act. Termination of defilement is symbolized by taking by hands a mouthful of water and spitting it out. Many people also prefer to take a bath as a continuation of this ritual. In any case, clothing worn during defecation is changed. Most adults change from their normal 'clean' clothes before going for defecation. The high castes are required to loop their sacred thread around their right ear (as a sign of desecration) until after they have purified themselves. Only the left hand must be used for ablution. Rural Bengalis scrupulously avoid the use of left hand for eating or handling any food (particularly meal) since it is defiled. These norms are followed with high conformity, and children are often reprimanded for not following the correct procedures. A visit to a fecally polluted bamboo grove for any other purpose would normally be undertaken before bath. Polluted fields are not avoided in the same manner as the bamboo groves are (except the very heavily polluted *hegomaths*).

Choice and Attitudes involved in Defecation Behaviour

A record was kept of explanations given by the subjects for chosing or avoiding certain habitats or certain portions there of, for defecation. These included: ownership of the plot; social relationship with the owner; use by other sex in family or in *para*; proximity to houses, ponds, roads, etc.; agricultural activities within or around the plot; the extent of ground cover; presence of insects; flooding; snakes; the amount of fecal pollution and foul smell; the direction of wind; weather; the time of the day or night; visibility from outside; convinience; and individual deocyncracies. These choices determine which plots or habitats are polluted more than the others.

The stool distribution patterns can be derived from these patterns of choices. Since most of the people use similar criteria and exercise similar choices in conformity to social conventions, they visit the same defecation grounds and tend to choose the same areas of defecation ground for defecation. This leads to a heavy fecal infestation in highly localized areas called defecation grounds. Some persons who are not consistent in following these conventions and do not exercise stereotyped choices consistantly tend to avoid the regular defecation grounds and the heavily polluted areas of the grounds. This leads to a moderate or patchy infestation. Some persons ('delinquents' and unsocialised children) pass stool in the plots where pollution is otherwise unexpected or socially disapproved. This leads to diffused infestation.

Defecation Habitats

Monthly records were made of the location of stools passed by the sub-sample subjects (N = 374) over one year period. It showed village to village differences (Kochar 1970). Only 0.8% of stools were actually passed in latrines. Fields and bamboo groves are the two major defecation habitats. The use of fields varies from 3.4% of all the stools recorded from village Bandipur to 82.6% of all the stools recorded from Laltejol. The percentage of stools passed in bamboo groves varies between 12% to 30% in most villages except the villages where there are only few bomboo groves. In Bandipur 75.9% of all the stools are passed in bomboo groves. Other habitats receive small amounts of fecal pollution. About 11% of all the stools are passed in the 'residential' areas mostly by children and aged adults. Abo

29% of all stools passed by children (below 10 years of age) are located within and around houses in the residential area. The overall sex differences in choice of habitats were found to be significant ($P<0.01$). The adult females tend to use the shaded habitats about 9.4% more often than the adult males who use fields more often (Table 1).

Table 1. Age-sex differences in the choice of defecation habitats.

	Percentage of total stools passed in each habitat			
	Fields	Bamboo groves	Residential	Other habitats
Adult-Males	50.6	23.9	0.1	24.6
Adult-Females	42.6	34.0	0.1	23.3
Children	34.8	12.5	28.9	24.0
All persons	42.6	22.4	10.7	24.3

Seasonal Changes in the Choice of Defecation Habitats

The villagers seasonally shift from the open habitat (fields) to the shaded habitats (bamboo groves etc.). Such changes, shown in figure 1, broadly correspond to the agricultural cycle and to seasonal changes. The greatest difference (40%) in the use of open and shaded habitats is in the wet season (June to August). In July and August about 62% of all stools passed by the adults are located in fields against 35-42% in April-May. These changes are slightly greater for the adult females than for the adult males. Between June to October adult males pass 56-65% of their stools in fields. Excluding Bandipur and Mohalla about 60-80% of all the stools passed by the adults are located in fields. In four villages 80-90% of all stools passed by the adults are located in fields. These seasonal shifts to fields are less pronounced in villages where fields close to the sample households are not abundant.

In the month of July and August 70% of all the stools passed in fields are located in Jute

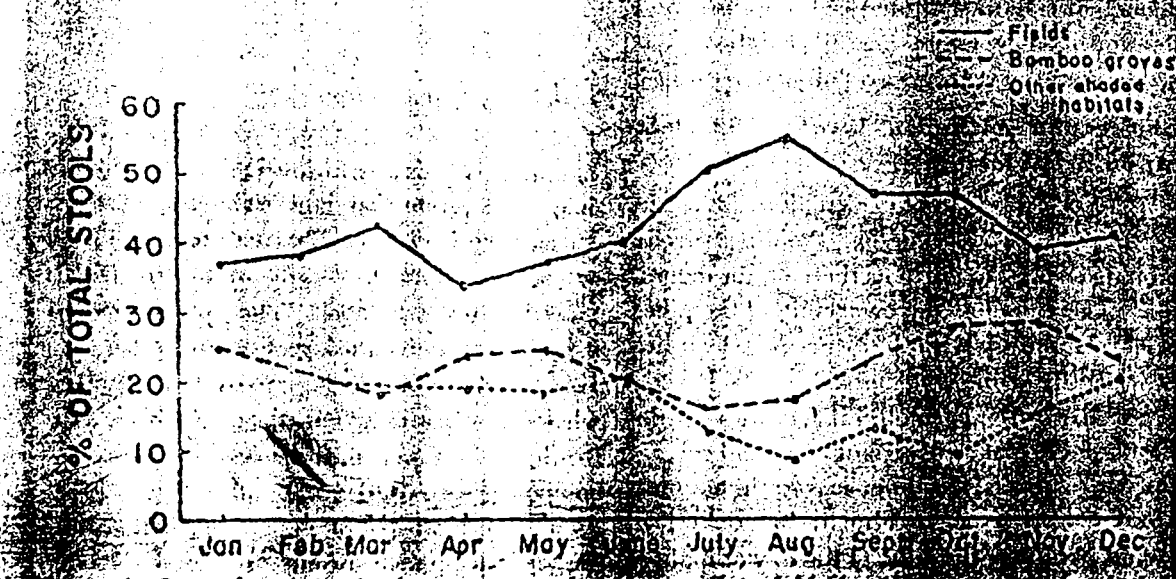

Figure 1. Seasonal variation in the percentage of stools passed in fields, bamboo groves and other shaded habitats.

fields. Although fields are referred to above as unshaded or open habitat, this is not strictly true in the case of jute fields where the standing crop provides a shade for the larvae on soil surface. Jute fields are considered pollutable after the farmers have completed weeding and the crop is two to three feet high (from the middle of June to the end of August when harvesting begins).

Seasonal changes in the time of defecation

Although the cultural norms specify that defecation should be completed shortly after geting up from bed, only 25% of the subjects actually completed the act between 5 and 6 AM. The actual behaviour is much varied (Kochar 1976). About 50% of the adults defecate before 9.30 AM. The overall sex differences in time of defecation are significant ($P < 0.01$). The differences are due to differences in the daily routine of the adult males and females.

Seasonal changes in the defecation activity have been reported before (Kochar 1976). The cool dry months (November to January) and the wet months (June to August) show significant contrast ($P < 0.01$). The sex differences are significant within the cool dry months but not within the wet months.

Equivocal Attitude Towards Avoidance of Fecal Pollution

On interrogation people generally reported that they do not like to defecate where other stools are present. Their professed avoidance of stools, their acute ability to recognize the obliterated stool spots, and the cultural norms of pollution and purity suggest that the people would scrupulously avoid stools in selecting a defecation spot. This however, is not generally the case.

If everybody strictly avoided the presence of other human stools in selecting a defecation spot, the stools would be more or less evenly distributed. However, it was found that a good proportion of stools is confined to the socially recognized defecation grounds. As pollution increases in one corner of the area the people gradually shift to another suitable corner and the intensity of fecal pollution in a given spot waxes and wanes.

When outside the defecation grounds the people show concern for fecal pollution within the grounds. For many persons simply entering a bamboo grove is itself a kind of pollution, requiring a washing of feet and changing of clothes or even bathing. The adults would not want to enter a bamboo grove when they are clean, but when within the grounds, for defecation or other work, they do not appear to be much concerned about stools around. The presence of other stools is only one of the considerations behind the choice of a defecation spot. The professed avoidance is with regard to the foul smell rather than the physical presence of stools.

Avoidance of other Stools at the Place of Defecation

The frequency with which the people squat within certain distance from other stools was recorded. About 45% of the identified stools ($N = 380$) are within six feet from a fresh stool heap and 81% squat within six feet from a trace of a stool. The average distance from the nearest stools is three to four feet. A trace of stool is avoided a little less than the other types of stools. Avoidance of stools is less among the adult males above 45 years than the adult males below 45 years. The females above 45 years of age tend to avoid other stools more than the female adolescents between 13-18 years. About 15% of males ($N = 78$) and 15% of the females ($N = 15$) squatted within 12 inches of a recognizable trace of a stool.

Use of defecation grounds

Certain plots with definite habitats are socially recognized as the defecation grounds. In the sample population (N = 735) 14.6% have a bamboo grove attached to their house and 9.9% have other shaded habitat which they use as defecation grounds. Of about 195 defecation grounds plotted on maps in the course of 12 monthly rounds of investigation only 27% are located in fields and the reminder are located in a variety of shaded habitats. Very heavily polluted fallow fields are called *hogomaths*. About 72% of the 'Identified stools' were found to be located in defecation grounds (56% in shaded habitats and 16% in fields). Of all stools identified in the shaded habitats 91% were located in defecation grounds while only 42% of all stools identified in fields were located in defecation grounds.

Use of Latrines

Only 9% of the households (N = 100) reported having some kind of a latrine and of these households only a few members actually use the latrines. Only 0.8% of the stools reported by the sub-sample subjects (over 12 monthly investigations) were passed in latrines. The people in general consider latrines as dirty, bothersome, difficult to service, unaesthetic and uncomfortable (Compare Hasan 1967).

Some simple latrine structures were noticed in the study area. Most of these were simple pits or natural slopes with either a platform or an enclosure or both. There was little systematic attempt to use what Chandler described as "natural latrines" or "standing places" commonly found in some parts of Eastern Bengal (Chandler 1926, 1926b, 1926 c, 1927).

Use of Footwear

Abour 49% of the subjects in the sub-sample (N = 240) roported owning some kind of foot wear. However people generally use footwear only on formal occasions. About 9.4% of them reported using a footwear when they go around in the hamlet. However only 2.2% of the people (N = 279) observed walking around in their *para* in normal routine were noted with shoes. Only two persons (0.9%) claimed using footwear when they go for defecation. Direct observations confirmed that the people rarely use footwear in places and at occasions when contacts with infested soil are more likely.

Behavioural and Social Regulation of Hookworm Infection

Space would not permit full exposition of the epidemiological and ecological significance of the data presented above. This is available elsewhere (Kochar 1975, 1976). The methodology may be described as follows:

1. On the basis of life cycle of the organism identify varied foci, organisms, crucial ecological conditions, modes and pathways of distribution, survival and transmission. Think of ecology and dynamics of parasite populations.

2. From available literature identify human situations, factors and behaviour patterns mentioned in relation to the given parasite. Complement this with a priori assessment of various other factors, situations and behaviour patterns that directly impinge upon factors identified under item 1.

3. Carefully describe and quantitate as far as possible the various human factors identified and ordered in to a sequence on the basis of key hypotheses.

4. Apply structural-functional logic to item 2 and identify other social and cultural factors, norms, situations on which the respective variables depend. Apply ethnographic

techniques to study these cultural components which control the prime determinants of parasite populations.

5. Ralate this data in item 3 and 4 to available quantitative information on the ecology of parasite populations in two ways: (i) how such factors affect the survival, development, and distribution of the parasite populations; and (ii) how the behaviour patterns affect the chances of contact with humans.

6. Work exact or probable net effect of each key factor on a specific landmark in the life table of the parasite population.

7. Identify key social and individual variables for a sample population. If possible include some health variables and diet factors relevant to the situation. Relate this to suitable indicators of prevalence, incidence and intensity of infection by applying suitable statistical methods. Determine what proportion of variance in infection can be explained by carefully selected parameters.

8. Examine the overall significance of the findings in culturo-logical terms to deduce basic outline of culture-parasite relationship.

9. Identify social and behavioural factors which can be profitably used in sanitation and public health programmes.

Overall Importance of Human Factors

In Bengal the enigma of high prevalence (90%) yet at the same time low intensity of infection (2,500 EPG)* has puzzled scientists since Chandler discovered it (Chandler, 1926-27). No control program has ever operated. It was suggested that some natural regulatory mechanisms are operating (Schiller and Choudhury, 1968). As part of an inderdisciplinary team attacking this problem, the basic theme which guided the present work is that in rural Bengali society, where endemic hookworm infection presumably has had long history, the customs and habits of the people regulate the hookworm populations and hookworm transmission. This is amply substantiated by the results of the study (Kochar 1975).

The socio-epidemiological model consisted of 11 contextual factors, 10 defecation factors and 10 health factors (as confounding variables). The binary multiple regression analysis based on the more significant components of this model revealed that the model can explain 62.7% of the variance (R^2) in the level of hookworm infection measured in terms of the average number of hookworm eggs per gram of feces derived from 10 consecutive rounds of fecal examination over a two year period (Schad *et al* 1973). This is equal to a multiple correlation of 0.79. A combination of various group attributes, individual attributes and behavioural attributes, governs the variation in the intensity of hookworm infection in the study population. The same social configuration (village, caste, religion, socio-economic status, family environment, individual occupation, age-sex roles, etc.), as one would expect to be relevant for other social phenomena are also found to be important in determining hookworm infection.

The positive and negative consequences of various habits and practices outlined above were explored in quantitative terms with reference to their impact on the survival of hookworm populations, pattern of their dispersal and aggregation, their contact with human hosts, and their success in penetrating skin (Kochar, 1975; 1976).

Ovicidal time-temperature durations were found, to affect [illegible] of the stools passed by the adults in [illegible]

* EPG = Hookworm Eggs per gram of feces.

before 10.30 AM. This is reflected in the average hookworm intensities in different village samples and the percentage of stools passed in fields. Seasonal shift from shaded habitats to open fields was found to be detrimental for hookworm populations. The habits and choices in selection of defecation spot leads to definite patterns of stool distribution which reflect larval aggregations. Average fecal densities encountered by the subjects during defecation activity represent a likelihood of positive contact with viable fecal points equal to 10% of the squattings. Highly localized distribution of stools in socially recognized defecation grounds was found to restrict transmission to defecation behaviour sequence, though appreciable amount of transmission (up to about 30%) through other activities was found to occur. Ablution soon after d[illegible]ically restricts the chances of i[illegible] other hand, universal practice of soil pollution and non-use of shoes account for a very high probability of contact with some hookworm larvae so that few could escape. It was found that given a different pattern of stool aggregation, defecation behavior and other conditions these probabilities of survival, contact and penetration can cause manifold differences in the level of infection within the same climatic and soil conditions. A uniformly high probability of contact with hookworm larvae and a uniformly low probability of larval contact, pick-up and penetration success partly account for the observed epidemiological pattern of high prevalence and low intensities of hookworm infection.

Socio-ecological situations and behaviour patterns that ensure the success of hookworm populations (risk factors) and those that restrict the success of hookworm populations (protective factors) are an integral part of the traditional setting of rural Bengali society and represent a socio-ecological equilibrium vis-a-vis distribution and abundance of hookworm populations (culture-parasite relationship). Some of the factors that protect humans from hookworm infection are a direct response of the human communities to the environmental risks and some protective factors are indirect consequences of human choices.

Protective Factors

Social stratification and customary role-status differentiation in society result in variations in behavior and social context. There are aspects of culture (such as passing stool on soil, not wearing shoes, etc.) that are shared by most of the community members ('invariant' or 'compulsive' patterns; Mandelbaum 1954). There are other aspects of culture that represent typical variations ('alternative' or 'optive' patterns) in the stratified social organization of rural Bengal (such as occupations, religion, caste, etc.). Some of these are socially or numerically dominant and some are subsidiary or minority types (e.g. low castes, Muslims). Some variations depend upon certain role-status types (femal workers). Some of the variations represent recent changes or innovations (such as jute crop). These patterns of social differentiation, relevent to hookworm infection, tell how socially pervasive and culturally deep rooted the risk factors and protective factors are.

The factors that ensure the success of a parasite and those that restrict its success are simultaneously present in a culture. Somehow, epidemiology and public health are traditionally concerned with the 'risk factors' only. This has often lead to a completely negative view of the native cultures. The knowledge of protective factors of is no less public health importance. Some studies have demonstrated existence of a pervasive system of preventive

and promotive practices in native cultures (Colson 1969; Chen 1970).

Table 2 lists a number of aspects of rural Bengali culture that have been identified in the present author's study on hookworm transmission as being protective (Kochar 1975). These factors, most of them, have actually been responsible for natural regulation of hookworm infection in the various parts of erstwhile State of Bengal (Chandler, 1927).

The stable culture-parasite relationship is, in part, based on those stable and persistent aspects of social and cultural organization which underlie the epidemiological patterns. How the pattern of hookworm infection will change depends, in part, on how the cultural configuration of socio-epidemiological and socio-ecological patterns change. If the success of the parasite were tied to a cultural setting, restricted to a situation, group or practice that is dying out due to rapid social change (e.g. going about bare feet) then the parasite also will die out. If, on the other hand, a new innovation or situation were to provide a highly successful pathway for the parasite (cf. cultivation of jute) then the fate of the parasite will be tied to the degree of diffusion of such an innovation. In fact some authors have suggested the use of parasite prevalence among different ethnic groups as an indicator of culture contact and social change.

Table 2. List of protective or low risk factors.

1. Simple latrines, natural latrines and standing places.
2. Strict avoidance of stool spots in selecting a squatting place leading to diffuse soil pollution decreasing the larval population per unit area.
3. Restricted frequency and duration of activities in defecation areas.
4. Defecation in open habitats decreasing the chances of survival of larval populations, particularly in the afternoon.
5. Universal avoidance of pollution of fields under crops thus restricting pollution in jute fields.
6. Defecation away from maximum interaction zone of the settlement.
7. Many defecation grounds (large area per person and lesser aggregation of larvae).
8. Shift from shaded areas to open fallow fields during the monsoon season.
9. Strict socialization of defecation habits.
10. Universal practice of ablution soon after defecation (or other activities in defecation grounds) and careful scrubbing of feet.
11. Recognition of the risk of infection, recognition of early symptoms of high infection and early health action.
12. Better foot condition and care of lesions on foot during monsoon season.
13. Short squatting time and lesser frequency of stools.
14. Higher intake of iron rich foods in the diet.
15. Non-agricultural family environment.
16. Non-agricultural occupations away from the villages.
17. Stable agricultural occupation (rather than agricultural labour).
18. Better socio-economic status.
19. Provision of proper defecation areas around schools.
20. Recognition of risk from obliterated stool spots.
21. Use of shoes and other footwear during defecation activity.
22. Use of latrines.

Behavioural control as part of sanitation programme

Evidence suggests that behavioural control of hookworm infection has actually been operating in the study population and is partly responsible for restricting hookworm infection to low levels. Similar conclusion is reported in some other studies (Cort 1926; Scott 1937). The same process can be reinforced by incorporating indigenous protective factors as a part of hookworm control program. Chandler emphasized such measures for control (Chandler 1926; 1927). From table 2 it can be seen that the use of simple/natural latrines, stricter avoidance of old stool spots, prompt ablution and washing of feet after defecation or other activity in defecation grounds, avoidance of defecation areas for other activities; care of foot lesions; avoidance of jute fields for defecation; creation of more defecation grounds in fallow fields; passing stool away from the settlement; regularity of defecation habits; intake of more pulses and leafy vegetables; early socialization of proper habits–all these would have a desirable affect on the hookworm situation. It was noticed that furrowing in banana groves creates an undulating surface which seemed to provide both 'simple latrines' and 'standing places.' People naturally walk and squat on the higher ground and defecate in the shallower portions. The possibility of furrowing important defecation groves can be considered. The antihelminthic efficacy of the folk medicines used for the removal of 'worms' is not well established (in terms of complete deworming). However, the possibility of limited effects (partial deworming) of the repeated doses of some folk and Ayurvedic antihelminthics should be explored. Popularising folk antihelminthics for periodic use during each transmission season should not be much of a problem. The ri[sk] to cultivators from ploughing the polluted fallow fields and harvesting polluted jute fields should receive some attention. Some simple remedies for adverse foot conditions during the monsoon season can also be popularized. Families of low castes, particularly those engaged in agricultural labour may already be at risk of hookworm disease due to a combination of adverse socio-economic conditions under which they live and work.

While the ideal goal of sanitary latrines and use of shoes may have to wait for many years to diffuse in the whole rural population, the behavioural control measures offer a chance of some intermediate relief and benefit in immediate future. Gain from such behavioural control of hookworm is far from complete and like other programmes, difficult to pursue in the absence of other concurrent measures (Cort 1922). However, once incorporated into the way of life, the behavioural and social changes are self-sustained measures [illegible] substantially reduce the health [illegible] pollution.

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