Physico-social environment and health in a rural area of Kathmandu: An ecological study

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ABSTRACT

The physico-social environment and it's consequence on health was studied in a rural area of Kathmandu. The design used was observational and correlational, where 465 families were selected. Data was collected from the head of the family (HOF) through pre-tested questionnaire to assess the physical housing environment, socioeconomic status and current morbidity status. Among the total, there were 409 (88%) male headed households (MHH) and 56 (12%) female headed households (FHH). Among the total, 110 HOF (23.7%) had not received any form of formal education. The average family size was 4.45 and the per-capita income was 29,261 (NRs) per-annum. There was overcrowding in 175 (37.6%) and inadequate cross-ventilation in 375 (80.6%). No separate kitchen was present in 218 (46.9%). Firewood, animal dung cakes and kerosene was used as fuel in 85 (18.3%). There was no toilet in 85 (18.3%) and 165 (35.5%) were indiscriminately throwing solid waste. Livestock was kept inside the premises in 93 (20%). Pests were present in 214 (46%) houses. Bacterial water quality analysis revealed an Maximum Probable Number (MPN) Index of>3-1100 coliformper 100ml (is this range correct?) in 366 (76.5%) in drinking water samples. Self reported problems were gastritis 95 (20.4%), chronic cough 82 (17.7%), headache 71 (15.2%), chest pain 56 (12%), hypertension 45 (9.7%), backache 42 (9%), diarrhoea 41 (8.8%), body pain 33 (7.1%), diabetes 21 (4.5%), urinary problem 22 (4.7%) constipation 17 (3.4%), hearing problems 15 (3.2%), joint pain 14 (3%), sleeplessness 13 (2.8%), depression 10 (2.1%), abdominal pain 7 (1.5%), paralysis 5 (1%) and thyroid enlargement 4 (0.9%). Absence of separate kitchen and toilet, use of biomass fuels, contamination of drinking water sources, and inadequate purification of drinking water continue to be environmental and health hazards in this community. Evidence based planning must be done, to reduce the environmental degradation and its impact on health.

Keywords: head of family, MPN index, biomass fuel, environment and morbidity.

INTRODUCTION

Health and environment issues are largely interdependent. The key to an individual's health largely lies in his environment. In fact, much of an individual's ill -health can be traced to adverse environmental factors such as water pollution, air pollution, soil pollution, poor housing conditions, presence of animal reservoirs and various insects acting as vectors of diseases. The term environmental sanitation is now being replaced by environmental health. Environmental health covers the assessment, correction, control and prevention of environmental factors that can adversely affect health as well as the enhancement of those aspects of the environment that can improve human health. Environmental health is focusing on protection from diseases through the provision of clean water, waste disposal, safe food, clean air, safe living and working conditions etc. The purpose of environmental health is to create and maintain ecological conditions that will promote health and environment in the future[1].

About 83.3 percent households of Nepal use biomass fuel as the primary source of energy [1]. Exposure to the smoke from a day's cooking is equivalent to smoking two packets of cigarettes, directly affecting the lungs and chest, posing risks for chronic respiratory disorders, acute respiratory infections including, pneumonia and bronchitis, chronic obstructive pulmonary disease, lung cancer, and other problems [2]. A study done by Nepal Health Research Council/World Health Organization (NHRC/WHO) in 2008 revealed that about 50% cases of acute lower respiratory infections (ALRI) were attributed to indoor smoke in Dhading district and the Disability Adjusted Life Years (DALYs) due to ARI was estimated to be 1284[3]. This study aims at evaluating the effect of physico-social environment in a rural area of Kathmandu on the community health status.

MATERIALS AND METHODS

This was an ecological study, observational and correlational in design. The study period was February 2013 to May 2014. The area of study was Kapan-Jorpati area in rural Kathmandu. Sampling technique was purposive. Two VDCs (Village Development Committee), Kapan and Jorpati were selected. A total of 465 head of families (409 male headed and 56 female headed) were selected by systematic random technique. The data were collected through semi-structured and pre-tested questionnaire. Data analysis was carried out using Microsoft Excel 2007. Verbal consent was taken by the researcher prior to data collection.

RESULTS

Among 465 families, there were 408 (88%) male headed households and 56 (12%) female headed households. The mean age of the head of families (HOF) was 40.1 years, from among which, 25 (5.4%) heads of the families were below 20 years of age, 155 (33.4%) were in of age 20-40 years, 191 (41.1%) were in the age group of 41-60 years andthe remaining were of age 60 years and above (Table 1).

Table 1: Age wise distribution of head of families

Age range	Frequency (n=465)	Percentage
<20	25	5.4
20-40	155	33.3
41-60	191	41.1
>61	94	20.2
Total	465	100

From among the total, 206 (44.3%) households had 2-4 family members, 179 (38.8%) households had 4-6 members and 80 (17.2%) households have 6 or more members in the

Table 2: Household size

Family numbers	Frequency (n=465)	Percentage
2- 4	206	44.3
4 – 6	179	38.5
>6	80	17.2
Total	465	100

Average household size = 4.45
family. Theaverage household sizewas 4.45 (Table 2).

Religion wise distribution of the respondentsshowed that the majority were Hindus (82.8%) followed by Buddhists (14.6%), Christians (2.1%), Kirats (0.9%) and others who did not disclose their religion (1.7%) (Table 3).

Table 3: Religion wise distribution of the respondents

Religion	Frequency (n=465)	Percentage
Hindu	385	82.8
Buddhist	48	10.3
Christian	20	4.3
Kirat	4	0.9
Other	8	1.7
Total	465	100

From the total, 438 (94.2%) of the respondents were married, 4 (0.9%) were separated, 12 (2.6%) were widow/widower, 5 (1%) living together and 6 (1.3%) weredivorced. Among those who were currently married, 445 (95.7%) were monogamous marriages and 15 (3.3%) were polygamous marriages. (Table 4)

Table 4: Marital status of the head of the families

Marital status	Frequency (n=465)	Percentage
Married	438	94.2
Divorced	6	1.3
Separated	4	0.9
Widow / Widower	12	2.6
Living together	5	1
Total	465	100

Among the respondents 110 (23.7%) were illiterate and 355 (76.3%) were literate. Among the literate, 145 (31.2%) had studied upto the primary level, 165 (35.5%) upto high school and 45 (9.6%) were graduates and above. (Table 5)

Table 5. Educational status of the head of family (HOF)

Level of education	Frequency (n=465)	Percentage
Illiterate	110	23.7
Primary level	145	31.2
High school level	165	35.5
Graduates and above	45	9.6

The occupation status of the families was agriculture related 108 (23.2%) skilled 155 (33.3) and unskilled labour 202 (43.5). The monthly income 255 (54%) familieswas less than NRS 10,000, 131 (28.2%) families income was NRS 11,000 – 15,000, 45 (9.7%) families income was NRS 16,000 – 20,000 and 34 (7.3%) families income was more than NRS 20,000. The average monthly income of the family was Rs 2438.47. The per capita income was Rs. 29261 per-annum. (Table 6)

Table 6. Occupation and monthly Income of the families

Monthly income (RS)	Frequency (n=465)	Percentage
Agriculture related	108	23.2
Skilled	155	33.3
Unskilled	202	43.5
Total	465	100
Monthly income (RS)		
<10,000	255	54.8
11,000 – 15,000	131	28.2
16,000 – 20,000	45	9.7
>20,000	34	7.3
Total	465	100

Per capita income per month = Rs. 2438.47

In 93 (20%) households, animals were kept within the premises.214 (46%) households were infested with insect/rats . Approximately fifty three percent of the households did not have a separate kitchen. In these houses, the bed room and kitchen were combined. Overcrowding was observed in 175 (37.6%). Cross ventilation was absent in 375 (80.6%) of the houses. From among the total, 447 (96%) of the households did not have a separate bath area, 172 (42.6%) did not have an indoor toilet and open field defecation was practised by 27 (5.8%) of the households. (Table 7)

Table7: Hazardous environmental conditions

Hazardous condition	Number of households	Percentage
Animal kept within house	93	20
Insect/rats in the house	214	46
Combined bedroom and kitchen	247	53.1
Overcrowding	175	37.6
No cross ventilation	375	80.6
No separate bathroom	447	96
No indoor toilet	172	42.6
Open field defecation	27	5.8

Pipe water supply was available in 241 (51%) households, deep well (tube-well) 180 (38.8%) and spout stone *(Dhungedhara/kuwa*) 44 (9.5%) were available for the rest, managed by the community for public use. Among the collected water sample, 24 (5.2%) samples were potable and 85 (18.3%) had MPN index < 3 coliform per100ml of water. MPN index > 3 coliformsamples in 155 (33.3%). 201 (43.2%) sample of water had high MPN index (>1100/per100ml) of water. PVC tanks were used by 394 (84.7%) households, earthenware vessels 25 (5.3%) and plastic gallon or bottles 18 (4%) for storing daily drinking water daily. (Table 8)

Table 8. Source, quality and storage of drinking water

Sources	Frequency (n=465)	Percentage
Tap water	241	51.8
Deep well (inar, tube-well)	180	38.7
Natural (Kuwa, Dhungedhara)	44	9.5
MPN index		
>1100/per100ml	201	43.2
>3 per 100ml	155	33.3
< 3 per 100ml	85	18.3
0 (nil)	24	5.2
Water container in house		
Plastic tank	394	84.7
Metal tank	28	6
Earthen ware	25	5.3
Plastic gallon/bottle	18	4
Total	465	100

Among the 465 households,85 (18.3%) usedfirewood and animal dung cakes, 38 (8.2%) used bio-gas plant for generating biogas and 342 (73.5%) usedpetroleum gas (LPG) as cooking fuel. (Figure1).

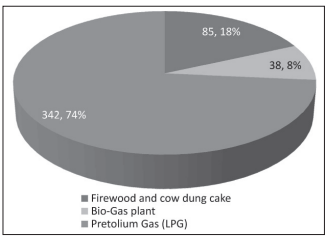

Fig 1: Type of fuel used in the households

Compost pits for solid waste disposal was used by 85 (18.3%) while 165 (35.5%) were indiscriminately throwing their solid wastes outside the house. One hundred and forty five (31.2%) were using services of VDC's agencies to collect solid waste. The disposal of liquid waste in 280 (60.2%) households was through the community drainage system, 95 (20.4%) used liquid waste in the kitchen garden and 90 (19.4%) let out the liquid waste in open fields (Table 9).Common health problems reported by the respondents weregastritis 95 (20.4%), chronic cough 82 (17.7%),headache 71 (15.2%), chest pain 56 (12%), hypertension 45 (9.7%),backache 42 (9%),diarrhoea 41 (8.8%), body pain 33 (7.1%), diabetes 21 (4.5%), urinary problem 22 (4.7%) constipation 17 (3.4%), hearing problems 15 (3.2%), joint pain 14 (3%),sleeplessness 13 (2.8%) depression 10 (2.1%),abdominal pain 7 (1.5%), paralysis 5 (1%) and thyroid enlargement 4 (0.9%) (Table 10).

Table 9: Methods of household waste disposal

Solid waste disposal	Frequency (n=465)	Percentage
Pits	85	18.3
Covered bin	70	15
Indiscriminately throwing	165	35.5
Serviced form	145	31.2
Liquid waste disposal		
Drainage system	280	60.2
Kitchen garden	95	20.4
Open field	90	19.4

Table 10: Self reported morbidity pattern

Morbidity	Frequency (n=465)	Percentage
Gastritis	95	20.4
Chronic cough	82	17.6
Dental problems	75	16.1
Headache	71	15.2
Chest pain	56	12
Hypertension	45	9.7
Backache	42	9
Diarrhoea	41	8.8
Asthma	39	8.4
Body pain	33	7.1
Urinary problem	22	4.7
Diabetes	21	4.5
Constipation	17	3.7
Hearing problems	15	3.2
Joint pain	14	3
Sleeplessness	13	2.8
Depression	10	2.1
Abdominal pain	7	1.5
Paralysis	5	1
Thyroid	4	0.9

DISCUSSION

The study was carried out in one of the rural areas of central Kathmandu Valley. The mean age of the respondents was 40.1 years. (Table 1) The average household size was 4.45. (Table 2) From among the respondents,95.2%were married, 1.3% divorced, 0.9% separated and 2.6% were either widow/widowers. Among the married, 3.3% had polygamous marriages. Arranged marriage was a common traditional practice (78.3%). Fourteen percent had love marriage, showing a modern trend and a deviation from the traditional practice. The educational status of the respondents played a vital role in determining their occupation. Some respondents had not obtained any form of formal education (23.3%) and those who had had higher education were employed in skilled occupations whereas those with lower forms of education depended on unskilled occupations . (Table 5). The average per capita income was Rs.29261 translated toper annum,which indicated that the respondents were above the poverty line (Table 6). In Nepal, the Census Board Survey 2010/11 mentioned that a person needs an income of at least Rs. 14430 a year equivalent to 1.25 US dollar per day to manage food equivalent to 2200 calories per dayand other essential non food items. As per the report, an individual earning less than Rs. 14430 per year is below the poverty line.[5] The prosperity of the family depends on active family members present in the family and is affected by the presence of dependents and also morbid conditions.

Multiple sources of drinking water were observed. The main source of drinking water was tap water by the Government followed by deep well and spout stone (Dhungedhara/kuwa) which was managed by the community for public use. The bacteriological water quality was not satisfactory. Only 5.2% sample were fitfor drinking and 94.8% samples had an MPN index ranging from 3 to 1100 coliforms /per100ml of water (Table 8). In this regard, NHRC and WHO 2006 disclosed that the water quality of all the samples tested were tested positive for coliform MPN index test. The water quality of different stone spouts showed that they were not far from the anthropogenic pollution.[6] The values for physiochemical parameters in the majority of tested samples from source, reservoirs and all the taps were found to lie within the National Drinking Water Quality Standard of Nepal 2062.[7] In this study storage of water in PVC tanks, earthenwares and plastic gallons or bottles might lead to other contamination (Table8). The people drank water directly from the source without treatment. A similar finding was reported by Non Government Organization Forumthat stone spouts have important traditional and aesthetic value so the local people consider it as pure and drink from it directly without any treatment placing them at risk to various water related diseases[8]. Another study showed that one of the major impacts of unsafe water is on public health. An important fraction of the total burden of disease worldwide (around 10%) could be prevented by improvements related to drinking-water, sanitation, and hygiene and water resource management [9].

In this study, a separate bathroom was present only in 4% of the households and 96% had no bathroom at all. They had to use common toilets and bathe near the community taps. The practice of open field defecation might be the causeof faecal contamination of water reflected by the high MPN Index (Table 8). ENPHO (Environment and Public Health Organization) 2007 mentioned that water testing results showed high proportion of water samples (sources, reservoirs and taps) were faecally contaminated. Out of total 66 sampled sources, 53 (80.3%) were contaminated with E. coli. Similarly, out of 34 samples from reservoirs, presence of *E.coli* was found in water samples from 24 reservoirs (70.6%). Out of 180 taps samples, 113 (62.8%) were contaminated with *E.coli.*[10]

In this study 18.3% households were using solid fuels, which is lower than the estimategiven by the Nepal Demographic Health Survey, 2006, whereabout 83.3 percent households of Nepal were using solid fuel as primary source of energy. So, it can be assumed that substantial burden of diseases are attributable to indoor air pollution. This problem is more pronounced in the rural parts of Nepal because they are poor and cannot afford to adopt costly fuels. It seems that the poor will continue using bio fuels seeing the pattern of development of our country. Women and children are particularly more exposed to indoor smoke due to limited ventilation. Most of the households (87%) use biomass fuel (dung, charcoal, wood, or crop residues) /coal followed by clean fuel such as kerosene/ LPG/ Bio-gas/ Electric Heater in Dhading district. [11]Indoor air pollution from household energy ranks as the fourth leading health risk in poor developing countries. The smoke from biomass fuels is a complex mixture of aerosols containing significant amounts of carbon monoxide (CO), suspended particulate matter, hydrocarbons and Nitrogen Oxide.[8]UNICEF (2008) reported that in India especially in rural areas, waste is becoming a severe threat to the public and affects the cleanliness. Though the form of waste in rural areas is predominantly organicsolid and liquid, it is still becoming a major problem to all. Absences of proper disposal of solid and liquid waste excreta were the leading causes of vector borne diseases and other water borne infections[12]. The health hazards of improper excreta disposal are soil pollution, water pollution and contamination of food and propagation of flies.[13]

The observation of the social environment of the households was that the animals were kept within the house, insectsand rats infestedthe house, bed-rooms were not separated from the kitchen. Overcrowding was seen in 37.6%, absence of cross ventilation and absence of separate bath-room/ indoor toilet indicated the probability of different communicable and non communicable diseases as in Table7. NHRC & WHO report 2009 reported that the people of the community felt that mosquitoes were "*shifting to higher altitudes where there was no previous occurrence*". Vector-borne diseases have now become a public health problem in Nepal.[14]

In a study carried out by Joshi *et al* in urban and rural parts of Haryana, India, anaemia, dental problems, cataract and hypertension were the common morbidities reported among elderly people [15]. In our study the health problems reported by the respondents were gastritis, chronic cough, headache, hearing problems, chest pain, hypertension, backache, diarrhoea, bodypain, diabetes, urinary problems, constipation, joint pain, sleeplessness, depression, abdominal pain, paralysis and thyroid enlargement (Table 10). Chronic cough, asthma, chest pain, headache may be correlated to the use of firewood as biomass fuels in 18% of the households. The practice of open field defecation was reported by 5.8% of the households and diarrhoeal diseases accounted for 8.8% of the reported morbidity (Table10). Sunder *et al* reported that, in a rural area of Haryana, India, the leading symptoms among elderly males were visual impairment (65%), chronic cough with or without expectoration and difficulty in breathing (58%), joint pains (51.8%), hearing problems (18.3%), and gastrointestinal problems (9.9%). [16]Garg*et al* reported that in urban areas, anaemia (39.6%), cataract (24.3%), refractory error (20.1%), hypertension (16.5%), arthritis (14.4%), and chronic bronchitis (9%) as common morbidities [17]. Purt AJ *et al*also found visual problems, arthritis/joint pains, respiratory problems and hearing problems were common morbidities among the studies.[18] There are various physico-social environmental risk factors which correlate with morbidity in rural Kathmandu, especially among the vulnerable groups. Exposure to indoor air pollution poses severe threats to one's health. Absence of separate kitchen, absence of toilet, use of biomass fuels, contamination of drinking water sources, and inadequate purification of drinking water continues to be an environmental health hazards in this community. Evidence based planning must be done, to reduce the environmental degradation and its impact on health.

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