

# Fact sheet on Sanitation



## Introduction to the main characteristics of human excreta and grey water

### INTRODUCTION

Faeces consist of digested food from the intestines, where bacteria help to decompose the food eaten. Urine is produced by the kidneys, which remove water, salts, and other substances of the blood through a filter process.

Grey water can be defined as wastewater generated in the households, excluding the waste(water) from a toilet. Grey water (also called sullage) therefore can include wastewater from bathroom sinks, baths and showers, but also wastewater from laundry facilities, dishwashers and kitchen sinks.

By understanding the composition of grey water and excreta, management systems can be designed in order to cope with the hazards and potentials posed by these flows. It should be noted that although vomit and menstrual blood are normally not considered when planning for sanitation, these flows can appear to be important aspects to consider when planning for sanitation systems.

### QUANTITIES

#### Volume of excreta

The volumes produced of faeces, urine and grey water varies from region to region.

The volumes of faeces and urine depend on the age of a person, the water consumption, climate, diet and occupation. Diet influences the volume of faeces according to the differences in digestibility of the food. Food low in fibre, for example meat, produces smaller quantities of faeces than food high in fibre, that has in addition an higher moisture content<sup>14</sup>. Also differences can be found between population living in the same region, in either urban areas or rural areas.

The amount of urine produced depends very much on temperature and humidity and ranges commonly from 0,6 to 1,1 litre per person a day<sup>16</sup>.

In order to know the amount of urine and faeces excreted in a situation, direct measurement is necessary.

The WHO suggests that in the absence of local information the following figures can be used as reasonable averages<sup>16</sup>.

Diet types	Faeces (wet mass) kg/cap day <sup>-1</sup>	Urine l/cap day <sup>-1</sup>
High-protein diet in a temperate climate	0,12	1,2
Vegetarian diet in a tropical climate	0,40	1,0

Some reported quantities of **urine** (adults) in various publications:

regions	volume l/cap day <sup>-1</sup>	Referen ce*
Not specified	0,8-1,5	7
Not specified	1,37	1
Europe and North America	1,2	9
The Netherlands	1,5	15
Sweden	1,5	7
China	1,6	7

\* numbers refer to bibliography

Some reported quantities of **faeces** excreted (adults):

regions	volume l/cap day <sup>-1</sup>	Referen ce*
Not specified	0,14	1
Europe and North America	0,15	9
Kenya	0,52	7
The Netherlands	0,19	15

\* numbers refer to bibliography

country	wet mass kg/cap day <sup>-1</sup>	Referen ce*
Sweden	0,14	7
China	0,26	7
India	0,28 (mean)	16
Peru (rural Indians)	0,32	16
Uganda (villagers)	0,47	16
Malaysia (rural)	0,48	16
Kenya	0,52	16

\* numbers refer to bibliography

#### Volume of grey water

Especially for grey water the amount produced varies greatly from region to region due to the fact that the amount depends on the volume of water consumed, and thus on the water supply service level, climate and water availability<sup>19</sup>.

Some reported quantities of **greywater** produced by households:

Region	Amount (l/cap day <sup>-1</sup> )	Reference
Not specified	68 - 274	4
'poor areas'	20-30	10, 20
The Netherlands	92,3 (mean)	15
USA	206	9
Germany (ecovillage Lubeck)	58 (mean)	10, 20
Sweden/Germany/Norway	<100	10

\* numbers refer to bibliography

## PATHOGEN CONTENT

### Pathogen content of excreta

From the function of the organs involved in the generation of urine and faeces it can be concluded that urine is generally a sterile product. However, faeces contain micro-organisms which can contain several types of pathogens among which bacteria, viruses, parasitic protozoa and helminths can be found.

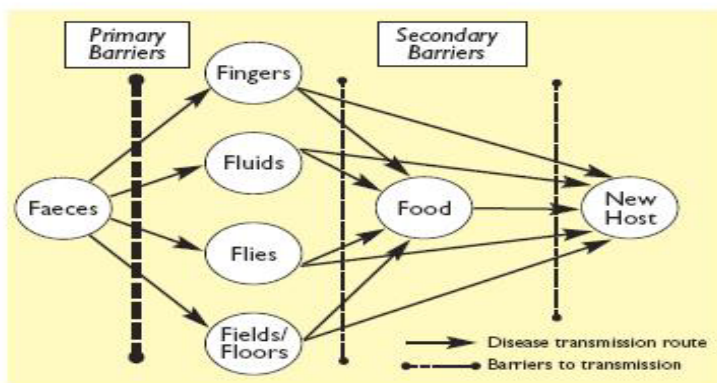


Fig.1 Disease transmission and control (source 18 after Wagner & Lanoix)

These pathogens could be transmitted to a new host by, for example hands, but there are also several other pathways through which people could be infected. See for potential transmission routes the figures below, which includes also the barriers that could be raised in order to prevent pathogens to enter a new host by the environment.<sup>18</sup> Not only hand washing after defecation, and before cooking is one of the barriers, but also the construction of sanitation facilities.

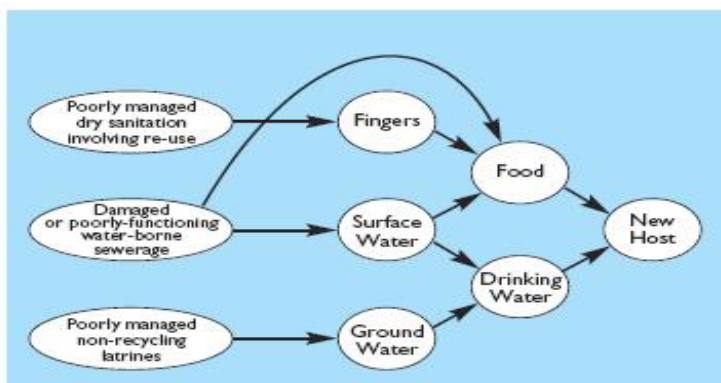


Fig. 2 Transmission pathways due to poorly managed sanitation (source 18 after Prüss et al.)

In case sanitation facilities are poorly planned, managed, or used, additional potential disease transmission routes could be established. See figure 2 Pathogens can remain infectious for long periods outside a human body, depending on the pathogen type and conditions of the environment. In general it can be said that the following factors can have a positive influence on pathogen die-off (based on <sup>12</sup>):

- High temperatures (> 40-50 °C)
- Alkaline conditions or acidic conditions
- Presence of ammonia (NH<sub>3</sub>)
- Low moisture content
- (treatment) with solar radiation / UV-light
- Presence of other micro organisms (competition)
- Low nutrient availability
- Other factors (e.g. retention time, oxygen availability)

### Pathogen content of grey water

Grey water generally doesn't contain pathogens. Pathogens only occur in grey water when wastewater from the toilet, or when faeces are added. The risk of infection is a function of the faecal contamination of the water.<sup>10</sup>

## NUTRIENT CONTENT

### Nutrient content of excreta and grey water

Both urine and faeces contain nutrients (e.g. nitrogen, phosphorous, potassium), of which urine contains the largest content of the total excreted amount of nutrients. On the other hand, the main part of carbon excreted can be found in faeces.

The following figure (fig.3) illustrates the nutrient distribution of grey water, urine and faeces:

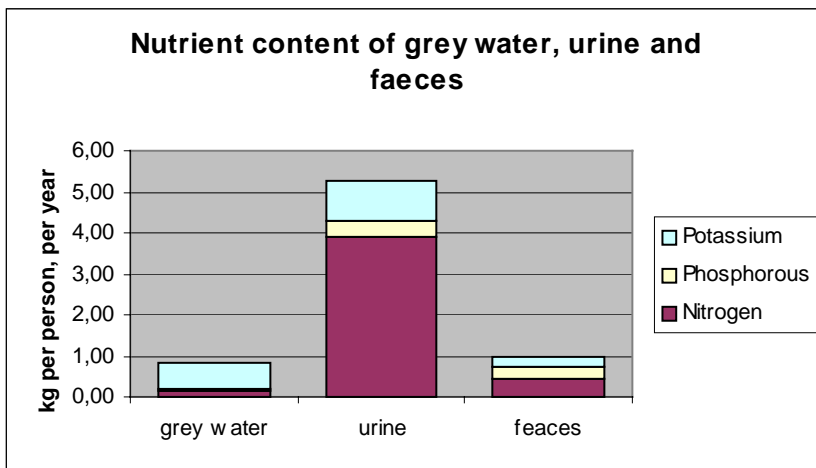


Fig. 3 Distribution of nutrients in grey water, urine and faeces, region not specified (source 4)

The nutrient contents as shown in the figure above, give a more general picture, because the nutrient content varies according to the differences in diet (digestibility of the food). The following relation is found between the food supplied according to the FAO and the excretion of Nitrogen and Phosphorous in total<sup>7</sup>:

$N = 0,13 * \text{grams of protein in total food}$   
 $P = 0,011 * (\text{grams of protein in total food} + \text{grams of protein in vegetable food})$

Although the nutrient content of grey water contains generally low levels of nutrients, high phosphorous levels can be found in certain circumstances. This is due to the fact that some washing and dishwashing powder contain phosphorous for softening the water<sup>10</sup>.

## OTHER SUBSTANCES TO THINK OF

### Faeces and urine

Hormones are produced by human bodies, and are excreted with the urine. But not only hormones are excreted with urine, also consumed pharmaceuticals are excreted with urine. It is found that these substances degrade the best in terrestrial environments by soil microbes and vegetation<sup>7</sup>.

Heavy metals and other contaminating substances, among which are pesticide residues, could be found in urine and faeces, depending on the amounts present in the consumed products. Urine normally contains low levels of heavy metals in comparison to faeces. This is due to the fact that urine originates from the filtering process of kidneys and the fact that intestines produce faeces through which heavy metals easily pass the body<sup>7</sup>.

### Grey water

The level of and the substances found in grey water vary according to lifestyles.

In grey water normally high levels of degradable organic materials can be found, among which are fat and oil, originating from cooking and washing activities.

Metals in grey water originate from several sources, among which are the corrosion of pipe systems, dust, cutlery, dyes, and shampoos. Other hazardous substances originate from perfumes, shampoos, paints, etc. It should be noted that the treatment methods of grey water only take out the 'unwanted' substances, they don't reduce the volume of water substantially.

**See also** Fact sheet on Grey water

## FOR FURTHER READING AND REFERENCES USED

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Year: 2005  
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