CHAPTER 2
REVIEW OF LITERATURE
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It is almost a quarter of a century since the world is living with Human Immuno deficiency virus (HIV) infection; and the bitter truth is that it is just the beginning. In these twenty-five years, AIDS has emerged as a major health emergency and is one of the greatest health crisis that the world faces today. This disease has not only affected the health of people but is also hampering social as well as economic development. In spite of large-scale efforts being put in by governments and health agencies, knowledge about the disease and its management is still lacking which is contributing to the Acquired Immuno Deficiency Syndrome (AIDS) pandemic. The stigma attached to the disease is also making the path of control and prevention difficult (WHO, 2008).

2.1 ABOUT THE DISEASE

The origin of HIV is still a mystery and there are different theories about its origin. However, the earliest case of HIV was detected in the blood sample of a man from the Democratic Republic of Congo in 1959. In India, the first case was reported from Chennai in 1986.

Human immunodeficiency virus or HIV is defined as a retrovirus that attacks and impairs the body’s natural defense system against disease and infection. CD4+ T cells are the victims of this disease which are disabled and killed during the course of the infection. According to WHO (2010), HIV infects cells of the immune system, destroying or impairing their function. Infection with the virus results in the progressive deterioration of the immune system, leading to “immune deficiency.” The immune system is considered deficient when it can no longer fulfill its role of fighting infection and disease. A healthy, uninfected person usually has 800-1200 CD4+ T cells per cubic millimetre of blood. During HIV infection, the number of these cells in a person’s blood progressively declines. Acquired immuno deficiency syndrome (AIDS) is an advanced stage of HIV when the person starts having opportunistic infections, or when the CD4 count is below 200 cells/cumm in the presence of HIV infection. Also, it is characterized by the occurrence of any of more than 20 opportunistic infections or HIV-related cancers.

It is a disease that affects humans leading to a weakened immune system through a virus which enters the body from fluids or unprotected behaviour, leading to various diseases and infections in the body.
Review of Literature

<table>
<thead>
<tr>
<th>H</th>
<th>I</th>
<th>V</th>
<th>A</th>
<th>I</th>
<th>D</th>
<th>S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human (one who is affected)</td>
<td>Immuno-deficiency (result)</td>
<td>Virus (causal agent)</td>
<td>Acquired (from bodily fluids through a behaviour or action)</td>
<td>Immune (where the virus attacks)</td>
<td>Deficiency (resulting effect of virus)</td>
<td>Syndrome (series of illnesses)</td>
</tr>
</tbody>
</table>

(Source: FANTA, 2004)

**Figure 2.1: Defining HIV/AIDS**

HIV infection follows a common pattern in all regions of the world, although the interval between phases may be shorter in developing than in industrialized countries (Bartlett and Finkbeiner, 1998). In industrialized countries, the average length of time between HIV and AIDS diagnosis is 8 – 10 years. In developing countries, this time period and the time between AIDS diagnosis and death is shortened due to exposure to pathogens and infectious diseases, poor health care and malnutrition (Grant et al, 1997; Morgan et al, 1997; Greenberg et al, 1998). The different phases of HIV infection are –

1. Acute Infection: This phase of infection lasts between 1 – 3 weeks. HIV causes symptoms of acute infection (such as fever, body ache, etc). Viral load is high at this time.
2. Seroconversion: Seroconversion usually takes place 6 – 12 weeks after HIV infection. At this stage, HIV antibodies can be measured through blood test.
3. Asymptomatic period: During this period, the infected individual’s immune system is gradually affected by the disease and CD4 T-lymphocyte cell counts gradually decline.
4. Early symptomatic infection: Common conditions include fungal infections of the mount, excessive bruising and bleeding, tuberculosis, chronic fatigue, fever, weight loss or diarrhoea. These conditions persist for several weeks or months.
5. Late symptomatic infection: This stage officially constitutes the condition called AIDS and it is defined by a blood test that confirms a low number of immune cells or by the presence of various other complications.

### 2.2 TESTS TO DIAGNOSE HIV AND TO MEASURE ITS PROGRESSION

In HIV infection, the virus in the blood can be demonstrated by nucleic acid-based test (PCR for pro-viral DNA and RT-PCR for viral RNA), p24 antigen testing or culture. Antibodies to HIV are detectable within four to six weeks of infection by commonly employed tests and in all individuals within six months. Once antibodies appear in the blood, they persist for lifetime (WHO, 2009). Diagnosis of HIV infection can be carried out by detecting antibodies to HIV, P24 HIV antigens or HIV nucleic acids in the blood (WHO, 2009; Nielsen and Bryson, 2000;
Bartlett and Finkbeiner, 1998 and Roitt et al, 1998). Antibodies to HIV can be detected through a test called Enzyme linked Immunosorbent Assay (ELISA). It is the most widely used technique for the detection of antibodies to HIV. CD4 cell count measures the number of CD4 cells, which are critical to the immune system’s functioning and which are destroyed by HIV infection. The levels of CD4 cell count (cells/cumm) indicate the various conditions i.e. average count in a healthy HIV negative individual is somewhere between 500 – 1400 cells/cumm. While count less than 500 cells/cumm indicates a damaged immune system, below 200 cells/cumm indicates that damage to immune system is severe and the patient is officially diagnosed of having AIDS. Disease is said to be in advance stage and the damage is irreparable if the count falls below 50 cells/cumm. – P24 HIV antigen test measures the actual HIV virus in the blood, and is a useful measure of infection during the period before which the body has developed measurable antibodies to HIV. HIV nucleic acid (RNA/DNA) tests are useful in defining or ruling out HIV infection in infants less than 18 months of age.

High cost of assays, need for cold chain for transport and storage of specimens pave ways for the need of newer technologies for HIV diagnosis. HIV antibody tests can also be performed on samples other than blood like saliva or urine. These tests are available, techniques are non-invasive and can be performed in peripheral centres but are expensive than blood tests. Also, techniques are developed for detecting the virus using dried blood spot. The advantage of this method is its stability at room temperature obviating the need for cold chain, suitability for community-based surveys and adaptability for collection of a large number of samples. The method is relatively new and needs to undergo vigorous quality assessment (FANTA, 2004). In India, NACO has set-up a regular schedule for CD4 monitoring of PLHIV adults as shown in Table 2.1.

<table>
<thead>
<tr>
<th>CD4 count (Cells/cumm)</th>
<th>Repeat at</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 350 and not on ART</td>
<td>3 months</td>
</tr>
<tr>
<td>&gt; 350 and not on ART</td>
<td>6 months</td>
</tr>
<tr>
<td>on ART (any value)</td>
<td>6 months</td>
</tr>
<tr>
<td>&gt; 500</td>
<td>Annual screening</td>
</tr>
</tbody>
</table>

If the CD4 count is between 200 to 250 cells/mm³ and the patient is not on ART; repeat CD4 assessment after 4 weeks and consider treatment in asymptomatic patients.

Source: NACO, 2007

2.3 WHO CLINICAL STAGING OF HIV IN ADULTS

The clinical staging for HIV was developed in 1986 for use among United States military personnel. For this the Walter Reed staging classification system which included both clinical and laboratory manifestations was used. But the system was not suitable for use in developing countries as it included a laboratory component. Therefore, to provide a comprehensive
clinical staging system, WHO in 1990 developed the staging system for adults and in 2003, the paediatric staging system was adopted.

The WHO (2007) clinical classification of HIV-associated disease is designed to be used in patients with confirmed HIV infection (Table 2.2). Along with measurement of the CD4 count, where available, the staging system is used to guide decisions on when to start opportunistic infections prophylaxis and when to start and switch antiretroviral therapy (ART). Clinical staging is done at the time of initial HIV diagnosis, upon entry into clinical care and at each clinical visit.

**Table 2.2: WHO’s Clinical staging of HIV for Adults**

<table>
<thead>
<tr>
<th>Clinical Stage</th>
<th>Symptomatic/ Asymptomatic</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td>Asymptomatic</td>
<td>Persistent generalized swelling of lymph nodes</td>
</tr>
<tr>
<td>Stage II</td>
<td>Symptomatic, Mild disease</td>
<td>Weight loss &lt;10% of body weight</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Herpes zoster within last five years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recurrent upper respiratory tract infections</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Angular cheilitis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recurrent oral ulcerations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pruritic popular eruptions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fungal nail infections</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Seborrhoeic dermatitis</td>
</tr>
<tr>
<td>Stage III</td>
<td>Symptomatic, Moderate disease</td>
<td>Unexplained severe weight loss (&gt;10% of body weight)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unexplained chronic diarrhoea &gt;1 month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unexplained prolonged fever &gt;1 month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oral candidiasis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oral hairy leukoplakia</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pulmonary tuberculosis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Severe bacterial infections</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Acute necrotizing ulcerative stomatitis, gingivitis or peridonotitis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unexplained anaemia (&lt;8g/dl), neutropenia (&lt;0.5X10⁹/L) or chronic thrombocytopenia (&lt;50X10⁹/L)</td>
</tr>
</tbody>
</table>
| Stage IV | Symptomatic, Severe disease | HIV wasting syndrome  
Pneumocystis jiroveci pneumonia (PCP)  
Recurrent severe bacterial pneumonia  
Chronic herpes simplex infection  
Oesophageal candidiasis  
Extrapulmonary TB  
Kaposi sarcoma  
Cytomegalovirus infection  
Toxoplasmosis of the central nervous system  
HIV encephalopathy  
Extrapulmonary cryptococcosis including meningitis  
Disseminated non-TB mycobacterial infection  
Progressive multifocal leukoencephalopathy  
Penicilliosis  
Chronic cryptosporidiosis  
Chronic isosporiasis  
Disseminated mycosis  
Recurrent septicaemia  
Lymphoma  
Invasive cervical carcinoma  
Atypical disseminated leishmaniasis  
Symptomatic HIV-associated nephropathy or HIV-associated cardiomyopathy |

(Source: WHO, 2007)

### 2.4 OPPORTUNISTIC INFECTIONS IN HIV

As there is no cure of HIV at present, therefore, the management of the disease becomes important. PLHIV may experience a variety of symptoms during the course of the disease. Often persons living with HIV encounter “opportunistic infections” (OIs) or illnesses. OIs are caused by microorganisms which do not normally become pathogenic in the presence of healthy immune system because healthy immune system will kill them or render them inert. But when the immune system is unable to defend the body because it is being destroyed by HIV, opportunistic infections will take any opportunity to attack the body successfully (Dyk, 2008). OIs can be bacterial (diarrhoea, TB, pneumonia, etc.), fungal (thrush, cryptococcal meningitis, etc.) or protozoal (pneumonia, cryptosporidiosis, etc).
The prolonged course of human immunodeficiency virus (HIV) infection is marked by a decrease in the number of circulating CD4+ T helper cells and persistent viral replication, resulting in immunologic decline and death from opportunistic infections and neoplasms (Haynes et al, 1996; Pantaleo and Fauci, 1996). Acute HIV infection is characterized by a drop in CD4 count within 3-6 wk of exposure (Kumarasamy et al, 2005). Associated symptoms with this initial stage of infection occur to varying degrees of severity and may include fever, sore throat, skin rash, lymphadenopathy, splenomegaly, myalgia, arthritis, and, less often, meningitis (Fauci et al, 1996). The acute phase is followed by a clinically latent period with low level viral replication and a gradual fall in CD4 count where the patient can remain asymptomatic for several months to years. Mean duration of survival after diagnosis with HIV in India is 92 months (Kumarasamy et al, 2003).

Clinical course and pattern of opportunistic infections varies from patient to patient and from country to country (Arminio et al, 1992; Mohar et al, 1992). For example, TB is the most common OI in HIV patients in India (Kumarasamy et al, 2003), whereas OIs like Mycobacterium avium complex (MAC) and Kaposi’s sarcoma, frequently reported in the developed world, are not as commonly reported in India (Mirdha, 2003; Lanjewar et al, 2002; Kumarasamy et al, 1996; Shroff et al, 1993).

2.4.1 Pulmonary diseases associated with HIV are among the most common and some of the most serious presenting illnesses in HIV-infected individuals. The common pulmonary problems associated with PLHIV and found in India include:

- **Tuberculosis**: HIV-TB co-infection is a serious problem worldwide, but especially of concern in India where background rates of TB are the highest in the world (Dye et al, 1999). Prevalence of HIV among patients with radiologic or bacteriologic confirmation of TB in India ranges from 2.8 to 9.4 percent (Gothi and Joshi, 2004; Prasad et al, 2004; Ramachandran et al, 2003; Sharma et al, 2003). In India, the most common opportunistic infection among people with HIV infection is pulmonary tuberculosis (Kumarasamy et al, 2003; Singh et al, 2003; Ghate et al, 2000). Extra-pulmonary tubercular manifestations occur in 46 to 79 percent of patients with pulmonary TB and HIV (Kumar et al, 2002; Lanjewar and Duggal 2001), and is more frequent in severely immunocompromised patients (Vajpayee et al, 2003). Extra-pulmonary TB has been reported in many organs: lymph nodes (most common), spleen, liver, bone, bone marrow, heart, central nervous system, gastrointestinal tract, kidneys, adrenals, thyroid, and prostate (Lanjewar and Duggal, 2001).

- **Pneumocystis jerovecii pneumonia (PCP)**: Pneumocystis jerovecii causes severe pneumonia in patients with AIDS. It is the most common AIDS-defining illness in the developed world (Jones et al, 1999). In India, however, very low rates (0.7 to 7%) (Gothi and Joshi, 2004; Kumarasamy et al, 2003; Rupali et al, 2003; Lanjewar and Duggal, 2001) of PCP have been reported. PCP occurs in patients with CD4 counts under 200 cells/μl; studies from Delhi and Chennai reported median CD4 counts of patients with PCP of 142 and 87 cells/μl respectively (Kumarasamy et al, 2003; Vajpayee et al, 2003).
• **Bacterial pneumonia:** Bacterial pneumonia was reported as an opportunistic infection in 1.8 percent of a large southern Indian cohort of HIV-positive patients (Gothi and Joshi, 2004). Rates of bacterial pneumonia can be up to 25-fold higher among HIV infected adults than in the general community (Feikin et al, 2004), with the most significant predictor of risk being level of immune suppression.

2.4.2 Oral lesions of HIV disease are common and are among the first signs of HIV infection and immune suppression. Studies show that oral lesions often co-occur with other diseases, especially pulmonary infections. For example, one study showed that 39 percent of those with oral lesions had concurrent pulmonary TB (Ranganathan et al, 2000).

• **Oral candidiasis:** Oral candidiasis occurs frequently in individuals with HIV infection; it has been reported as the most common HIV-associated condition, occurring in up to 70 percent of cases (Kumarasamy et al, 2003; Singh et al, 2003; Gha te et al, 2000; Ranganathan et al, 2000).

• **Periodontal disease:** HIV infection is associated with three characteristic presentations of periodontal disease: necrotizing periodontal disease, linear gingival erythema (LGE), and exacerbated attachment loss (Robinson, 1997). Gingivitis of unspecified kind has been reported in 24 to 47 percent of HIV positive cohorts (Ranganathan et al, 2000).

• **Oral hairy leukoplakia (OHL):** Worldwide, prevalence of OHL among HIV infected individual ranges from 0 to 26 percent (Holmes and Stephen, 2002). One study in south India reported OHL in 4 percent of 594 HIV positive individuals (Kumarasamy et al, 2003). The positive predictive value of OHL for low CD4 count has been reported at 66 percent (Patton, 2000).

• **Oral ulcers:** Oral ulcers in HIV can be caused by a number of infections, primarily, Herpes Simplex Virus (HSV). Background prevalence of latent HSV-1 infection in India is 78 percent (Cowan et al, 2003). Herpes simplex lesions are the third most common mucocutaneous lesion in HIV-infected individuals after candida and dermatophytosis (Singh et al, 1999).

• **Oral pigmentation:** Oral pigmentation, patchy brown to brownish-black asymmetrical lesions usually greater than 1cm, which are distinctive from racial oral pigmentation, have been reported in up to 23 percent of HIV positive individuals (Ranganathan et al, 2000). The etiology of these lesions is unclear and needs investigation.

2.4.3 Dermatologic Conditions which can be the initial presenting signs of HIV.

• **Infectious Conditions:** Herpes zoster can occur early in the course of HIV disease and generally precedes other skin manifestations of HIV disease. A study which showed increased prevalence of herpes zoster among injection drug user in Manipur, attributed it to the newly blossoming HIV epidemic in that population (Panda et al, 1994). Eight percent of patients with HIV had herpes zoster, at a median CD4 count of 250 cells/μl. There was no associated increase in mortality (Kumarasamy et al, 2003).

• **Autoimmune Conditions:** Papular pruritic eruption (PPE) is a unique dermatosis associated with advanced HIV infection, characterized by sterile papules, nodules, or pustules with a hyperpigmented, urticarial appearance, and pruritis (Bason et al, 1993).
• **Cutaneous malignancies:** Cutaneous malignancies reported in Indian literature include squamous cell carcinoma, basal cell carcinoma, and Kaposi’s sarcoma (Lanjewar et al, 2002). Kaposi’s sarcoma has been widely reported in the developed world and parts of Africa. However, there have been few reports of this malignancy in India (Lanjewar et al, 2002; Kumarasamy et al, 1996; Shroff et al, 1996).

2.4.4 **Neurological complications** of HIV disease can be seen in 20 percent of outpatients in HIV clinics and almost half of HIV patients being treated as inpatients (Wadia et al, 2001).

• **Opportunistic infections in central nervous system (CNS):** Cryptococcal meningitis (CM) has been reported as the most common opportunistic infection of the CNS among Indian patients with HIV (Wadia et al, 2001; Satishchandra et al, 2000). It accounted for 2 - 4.7 percent of all opportunistic infections in two large HIV-positive patient cohorts in Mumbai and Chennai (Kumarasamy et al, 2003; Vajpayee et al, 2003). In southern Indian patients, diagnosis of CM was associated with a 7-fold increase in risk of death (Kumarasamy et al, 2003). Other CNS opportunistic infections reported in India include herpes encephalitis, fulminant pyogenic meningitis, meningococcal meningitis, canthamoeba infection, aspergillus infection, rhizopus infection, and neurosyphilis (Satishchandra et al, 2000). There have also been a few scattered cases of primary multifocal eukoencephelopathy (Shankar et al, 2003; Chadha et al, 2000).

• **AIDS dementia complex:** Reports about AIDS dementia complex (ADC) in India are minimal, Review of literature revealed one study in Jaipur of 30 AIDS patients, 4 of whom were diagnosed with ADC (Kothari and Goyal, 2001).

• **Vasculitis/stroke:** Stroke in patients with AIDS can be secondary to a number of causes – haematogenous fungal infection, herpes simplex encephalitis, cerebral varicella zoster or neurosyphilis, among others. HIV infection itself can cause vascular endothelial damage, predisposing patients with advanced disease to stroke. In an autopsy study of AIDS patients, infarcts/haemorrhages were present in 15 percent of cases (Lanjewar et al, 1998).

2.4.5 **Gastrointestinal Manifestations** are also common in PLHIV which may be listed as follows –

• **Esophagitis:** Esophagitis, causing dysphagia or odynophagia, is very common among patients with advanced HIV disease (Kumarasamy et al, 2005).

• **Diarrhoeal diseases:** Chronic diarrhoea is a major problem in HIV infected persons, affecting up to 76 percent of those with AIDS (Misra et al, 1998). It is associated with a 3.3 fold increased risk of disease progression (Hira et al, 2003).

• **Hepatitis B and C:** Hepatitis B and C have the same risk factors for transmission as HIV. Concurrent infection with HIV and hepatitis B and/or C is of great concern in the developed world where co-infection rates are as high as 89 percent in some cohorts (Quan et al, 1993). In India, rates of co-infection with HIV and hepatitis B are reported between six and 33 percent (Kumarasamy et al, 2003; Sud et al, 2001). In a study in the eastern state of Manipur, where intravenous drug use is high, 92 percent of HIV positive intravenous drug users (IVDUs) were co-infected with hepatitis C (Saha et al, 2000).
2.4.6 **Ocular conditions** associated with AIDS in India have also been reported. These include extensive blepharitis and spontaneous lid ulcer (Biswas et al, 1997), frosted branch angiitis due to CMV retinitis (Biswas et al, 1999), subretinal cysticercosis, herpes simplex keratitis (Pramod et al, 2000), bilateral papilloedema with cryptococcal meningitis, squamous cell carcinoma, and immune recovery vitritis following treatment with protease inhibitors (Choudhury et al, 1999). The most common ophthalmic opportunistic infection in India is CMV retinitis, which almost always occurs in patients with CD4 counts <50 cells/μl (Biswas et al, 2000). The second most common ophthalmic manifestation of HIV infection is non-infectious retinopathy (HIV retinopathy), reported in 13-15 percent of HIV patients presenting to an ophthalmologist (Biswas et al, 2000).

2.5 **PREVALENCE OF HIV/AIDS**

UN General Assembly in 2011 passed a political declaration on HIV/AIDS wherein they stressed on intensifying the efforts to eliminate HIV/AIDS. It was recognized that HIV and AIDS are affecting every region of the world and each country’s epidemic is distinctive in terms of drivers, vulnerabilities, aggravating factors and the populations that are affected. Therefore, the countries efforts must be uniquely tailored taking into account its epidemiological and social context (UN, 2011).

2.5.1 **Global HIV Epidemic**

According to UNAIDS/WHO (2009) an estimated 33.4 million (31.1 million – 35.8 million) people are currently living with HIV. In 2008, an estimated 2.7 million (2.4 million – 3.0 million) people were newly infected with HIV. The majority of the new infections were in low and middle-income countries. The number of new HIV infections decreased by approximately 15 percent from 2001 to 2008 globally. Also, around 2 million (1.7 million – 2.4 million) people died due to AIDS related illnesses.

Women account for 50 percent of people living with HIV, although this proportion varies from 27 percent in the American region to 58 percent in the African region (Figure 2.2).

Globally 0.8 percent of adult population is infected with HIV. Sub-Saharan Africa continues to bear the brunt of the global epidemic accounting for two-thirds of all people living with HIV/ AIDS and 70 percent of global AIDS deaths. South Africa has the highest number of people living with HIV worldwide. The epicentre of the global HIV epidemic is in southern Africa, where nine countries have HIV prevalence about 10 percent and three countries (Swaziland, Botswana and Lesotho) have an adult prevalence above 20 percent.
2.5.2 HIV Epidemic in South-East Asia Region

South-East Asia Region (SEAR) comprises of eleven countries namely Bangladesh, Bhutan, DPR Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand and Timor Leste and is home to 1.76 billion people. The first case in the Region was reported from Thailand in 1984. The region has third highest burden in the world after sub-Saharan Africa and the Americas, accounting for 10 percent of all people living with HIV (WHO, 2009).

The overall adult HIV prevalence in SEAR is 0.3 percent which is much lower than in sub-Saharan African region which is 4.9 percent. However, due to the large population in SEAR, even a low HIV prevalence means that large number of people are infected with the virus. The prevalence of HIV among adult population in the region is shown in Figure 2.3. Five countries account for the majority of the burden in the region – India, Indonesia, Myanmar, Nepal and Thailand. No case has been reported from DPR Korea. The remaining five countries – Bangladesh, Bhutan, Maldives, Sri Lanka and Timor Leste, together represent less than 1 percent of the total HIV burden in the Region.

Within countries, HIV prevalence is higher in urban than in rural areas. A large household survey of six states of India found that HIV prevalence was 40 percent higher in urban than in rural areas (NFHS-3, 2006). Of the 96 new HIV cases reported in 2008 in Sri Lanka, 61 percent were from the capital city of Colombo alone. Similarly, in Bangladesh, HIV is mostly prevalent in the capital city of Dhaka (WHO, 2009).
On an average, 1 million women (aged 15 and above) are currently living with HIV infection in SEA Region. The proportion of the women currently living with HIV infection in the region is (33%) which is lower than the global average of (50%). In all countries except Bhutan, female to male ratio is less than 1. In Thailand, the proportion of women among all reported AIDS cases has increased from 14 percent in 1990 to 39 percent in 2008. Gender inequality, male dominance, stigma, low literacy and barriers to health care services are some of the key issues responsible for higher vulnerability of women to the HIV (WHO, 2009).

### 2.5.3 HIV/AIDS in India

India is home to 1.1 billion people and is the second most populous country in the world. The large population of the country is at an increased risk of HIV infection due to multiple reasons like poverty, illiteracy, ignorance, large populations residing in unhygienic conditions/environment, etc. The HIV epidemic in India is summarized in Table 2.3 below –
Table 2.3: Summarizing HIV in India

<table>
<thead>
<tr>
<th>Population</th>
<th>1.1 bn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male/Female</td>
<td>51.7% / 48.3%</td>
</tr>
<tr>
<td>Rural/Urban</td>
<td>72.2% / 27.8%</td>
</tr>
<tr>
<td>Sex workers</td>
<td>0.8 – 1.2 m</td>
</tr>
<tr>
<td>IDU’s</td>
<td>0.16m</td>
</tr>
<tr>
<td>MSM</td>
<td>2.5m</td>
</tr>
<tr>
<td>First HIV case reported</td>
<td>1986 (Tamil Nadu)</td>
</tr>
<tr>
<td>Adult HIV prevalence</td>
<td>0.29%</td>
</tr>
<tr>
<td>Estimated PLHIV</td>
<td>2.2 million</td>
</tr>
<tr>
<td>% women</td>
<td>39%</td>
</tr>
<tr>
<td>Major route of transmission</td>
<td>Heterosexual (87.1%)</td>
</tr>
<tr>
<td>National Response</td>
<td>NACO under MOHFW</td>
</tr>
<tr>
<td>Total ART centres</td>
<td>269</td>
</tr>
<tr>
<td>Adults on ART</td>
<td>2,93,979</td>
</tr>
<tr>
<td>Children on ART</td>
<td>19,182</td>
</tr>
</tbody>
</table>

(Source: NACO 2010; Census 2001; personal communication)

According to the NACO (2010) estimates, the total number of people living with HIV/AIDS in India is estimated at 23.9 lakh (19.3 – 30.4 lakh) in 2009. Children under 15 yrs account for 3.5 percent of all infections, while 83 percent are in the age group 15-49 years. Of all HIV infections, 39 percent (9.3 lakhs) are among women. The four high prevalence states of South India (Andhra Pradesh–5 lakhs, Maharashtra–4.2 lakhs, Karnataka–2.5 lakhs, Tamil Nadu–1.5 lakhs) account for 55 percent of all HIV infections in the country. West Bengal, Gujarat, Bihar and Uttar Pradesh are estimated to have more than one lakh PLHIV each and together account for another 22 percent of HIV infections in India. The states of Punjab, Orissa, Rajasthan and Madhya Pradesh have 50,000–1 lakh HIV infections each and together account for another 12 percent of HIV infections. These states, in spite of low HIV prevalence, have large number of PLHA due to the The HIV/AIDS pandemic is unevenly distributed in the country.

Based on antenatal clinic (ANC) prevalence, six states in India have been identified as high prevalence states (having more than 1.0% HIV prevalence in general population), three states as moderate prevalence states (concentrated epidemic with more than 5.0% HIV prevalence only in high-risk population) and the rest as low prevalence states (Table 2.4).
Table 2.4: Prevalence of HIV/AIDS in India

<table>
<thead>
<tr>
<th>High prevalence</th>
<th>Moderate prevalence</th>
<th>Low Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>(&gt;1% prevalence in general population)</td>
<td>(&gt;5% prevalence in high-risk group population)</td>
<td>Highly vulnerable</td>
</tr>
<tr>
<td>Tamil Nadu, Andhra Pradesh, Maharashtra, Karnataka, Nagaland, Manipur</td>
<td>Gujarat, Goa and Pondicherry</td>
<td>Assam, Bihar, Delhi, Himachal Pradesh, Kerala, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh, West Bengal, Chhattisgarh, Jharkhand, Orissa and Uttarakhand</td>
</tr>
</tbody>
</table>

(Source: National AIDS Control Programme, Phase III, 2006)

Figure 2.4 shows the trend in the prevalence of HIV infection in the country. It can be seen that the prevalence rates have been stabilized in the country and are on the decreasing trend. The prevalence rates have declined from 0.39 percent in 2004 to 0.31 percent in 2009. Of the 1.2 lakh estimated new infections in 2009, the six high prevalence states account for 39 percent of the cases, while the states of Odisha, Bihar, West Bengal, Uttar Pradesh, Rajasthan, Madhya Pradesh and Gujarat account for 41 percent of new infections.

(Source: NACO Annual Report, 2010-11)
2.6 MODES OF TRANSMISSION

HIV virus is usually spread through three major routes – through an exchange of body fluids, primarily during an unprotected sexual intercourse between an infected person and his/her partner (man to woman, woman to man, and man to man); exchange of infected blood during transfusion, or by skin-piercing instruments – e.g. sharing contaminated needles and syringes during injecting-drug use or rarely at health care settings and from infected mother to her unborn child (MTCT) during pregnancy, childbirth or breastfeeding. The risk of transmission of the infection in the absence of the interventions differ during different stages. The risk is shown in Table 2.5 below –

Table 2.5: Estimated risk of MTCT of HIV in the Absence of Interventions

<table>
<thead>
<tr>
<th>Timing</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>During Pregnancy</td>
<td>5 – 10%</td>
</tr>
<tr>
<td>During labour and delivery</td>
<td>10 – 15%</td>
</tr>
<tr>
<td>During breastfeeding</td>
<td>5 – 20%</td>
</tr>
<tr>
<td>Overall without breastfeeding</td>
<td>15 – 25%</td>
</tr>
<tr>
<td>Overall with breastfeeding to 6 months</td>
<td>20 – 35%</td>
</tr>
<tr>
<td>Overall with breastfeeding to 18 to 24 months</td>
<td>30 – 45%</td>
</tr>
</tbody>
</table>

Source: De Cock et al, 2000

2.6.1 Global Data

Different regions have different modes of virus transmission depending upon the living conditions and habits. In Sub-Saharan Africa, heterosexual intercourse is the primary mode of HIV transmission with extensive ongoing transmission to neonates and breastfed babies. In Asia there is concentrated epidemic among high-risk groups (IDU’s, sex workers and their clients and MSMs). However, in many parts of Asia, HIV is steadily expanding into low-risk populations through transmission to the sexual partners of those most at risk. While in Eastern Europe and Central Asia, injecting drug use is the primary route of transmission and as most IDU’s are sexually active – often with non-injecting partners – a major injection-driven epidemic has inevitably fuelled a growth in heterosexual acquisition of HIV in the Region. In Caribbean region heterosexual mode (among sex workers) is the major route of virus transmission. In Latin America, Men who have sex with men account for the largest share of infection with notable burden of infection among injecting drug uses as well as sex workers and their clients. In North America and Western and Central Europeand in Oceania, heterosexual mode and men who have sex with men is the common route of viral transmission. In Middle East and North Africa – Concentrated epidemic among high-risk groups (IDU’s, sex workers and their clients and MSMs) is contributing to ongoing transmission to “low risk” sexual partners.
2.6.2 Indian Data
In India, based on Programme data, unprotected sex (87.4% heterosexual and 1.3% homosexual) is the major route of HIV transmission, followed by transmission from Parent to Child (5.4%) and use of infected blood and blood products (1.0%). Injecting Drug Use is the predominant route of transmission in north eastern states where it accounts for 1.6 percent of HIV infections (Figure 2.5).

![Figure 2.5: Mode of Transmission of HIV in India](image)

Most of the states in India have a concentrated epidemic, focused in sub-populations, which are relatively more at risk of acquiring HIV due to their occupation (sex workers), sexual preferences (men who have sex with men) (MSM) or for recreation (injecting drug users) (IDU), and these groups are hence called as high-risk groups. A concentrated epidemic situation was seen in India in 2008-09 with a very high prevalence among high risk groups – IDU (9.19%), MSM (7.3%), FSW (4.94%) and STI clinic attendees (2.46%), and low prevalence among ANC attendees (0.48%). At all India level, an overall decline in the ANC attendees is reported, however, a rising trend is observed in some low and moderate prevalence states like Gujarat, Rajasthan, Orissa, Uttar Pradesh, Bihar and West Bengal,

2.7 NATIONAL RESPONSE TO THE EPIDEMIC
HIV/AIDS has become one of the most serious public health challenges in India. Since the first case reported in 1986 from Chennai, HIV has spread rapidly from urban to rural areas and from high-risk groups to the general population and from males to females. India’s initial response to the HIV/AIDS challenge was in the form of setting up of an AIDS Task Force by the Indian Council of Medical Research (ICMR) and a National AIDS Committee (NAC) headed by the secretary, Ministry of Health in 1990. A Medium Term Plan (MTP 1990-1992) was launched in four states, namely, Tamil Nadu, Maharashtra, West Bengal and Manipur and four metropolitan cities, namely, Chennai, Kolkata, Mumbai and Delhi.
In 1992, the Government launched the first National AIDS Control Programme (NACP – I). NACP I was implemented during 1992-1999 with an objective to slow down the spread of HIV infections so as to reduce morbidity, mortality and impact of AIDS in the country. To strengthen the management capacity, a National AIDS Control Board (NACB) was constituted and an autonomous National AIDS Control Organization (NACO) was set up to implement the project in 1993. National coordination of the AIDS control programmes is the responsibility of NACO, and each state has a State AIDS Control Society. The State AIDS Control Society works with nongovernmental organizations and private-sector organizations that implement targeted interventions, and holds regular coordination meetings. In most states, representatives of nongovernmental organizations are members of the board of the State AIDS Control Society.

In 1999, the second National AIDS Control Project (NACP-II) was launched. The focus shifted from raising awareness to changing behaviour, decentralization of programme implementation at the state level and greater involvement of the NGO’s. The NACP-II had the tow key objectives–

1. To reduce the spread of HIV infection in India;
2. To increase India’s capacity to respond to HIV/AIDS on a long-term basis.

Presently, NACP-III is operational (2007-2012) and the overall goal is to halt and reverse the epidemic in India over the next 5 years by integrating programmes for prevention, care, support and treatment. This will be achieved through a four-pronged strategy –

1. Prevention of new infections in high-risk groups and general population through:
   - Saturation of coverage of high-risk groups with targeted interventions (TI)
   - Scaled up interventions in the general population
2. Providing greater care, support and treatment to larger number of PLHIV
3. Strengthening the infrastructure, systems and human resources in prevention, care, support and treatment programmes at the district, state and national level.
4. Strengthening the nationwide Strategic Information Management System.

The specific objective is to reduce new infection as estimated in the first year of the programme by sixty percent (60%) in high prevalence states so as to obtain the reversal of the epidemic; and forty percent (40%) in the vulnerable states so as to stabilize the epidemic.

India has begun to implement phase III of national programme (NACP III). It is a well developed resource plan providing large funding for supporting family care programmes. NACP III mentions nutrition support as one of the activity but there is no blue print or operational plan for the same.

NACP III had numerous key achievements during the span of 2007-12. Various targeted intervention projects provided prevention and care services, covering 53 percent of female sex
workers, 74 percent of injecting drug users and 78 percent of MSMs. Access to safe blood has been ensured through a network of 1102 blood banks. A total of 5135 Integrated Counselling and Testing Centres have been operational catering to 60.8 lakh general clients and 44 lakh pregnant women were counselled and tested. During 2009-10, regular campaigns were conducted on mass media, supported by outdoor activities, mid-media and inter-personal communications. NACO released campaigns on Voluntary Blood Donation, ICTC and condom promotion, HIVTB and Prevention of parent-to-child transmission (PPTCT). 7,677 Red Ribbon Clubs in colleges encourage peer-to-peer messaging on HIV prevention. The Red Ribbon Express (RRE) is the world’s largest mass mobilisation against HIV/AIDS has entered its second phase. The free ART programme for PLHA has been scaled up to 239 centres. 3,00,743 patients are being provided free ART as of January, 2010 which include 18,889 children. With the rollout of second line ART expanded from January 2009, currently there are 970 patients on second line ART provided through 10 Centres of Excellence. Capacity for laboratories for CD4 testing has been strengthened with 209 CD4 machines. Also, the ‘National Ethics Guidelines for Research in HIV/AIDS’ were reviewed and finalised.

2.7.1 NACP IV (2012 – 2017)
A draft strategy paper for NACP IV has been prepared during the XII Plan discussions. The strategy paper outlines the following objectives for NACP IV – (NACO, 2011)
1. (a) 80% reduction in new infections in high prevalence states;
   (b) 60% in low prevalence states
2. Comprehensive Care, Support and Treatment to all persons living with HIV/AIDS.
It is envisioned that these objectives would be achieved by intensifying and consolidating quality prevention services to HRGs and vulnerable populations; increasing access and promoting innovative and sustainable mechanisms for comprehensive Care, Support and Treatment; expanding IEC services for general population and High Risk groups with a focus on behavior change and demand generation; strengthening institutional capacities and process of integration; enhancing access, coverage and quality of services by leveraging partnerships and by strengthening programme initiatives through innovations.

2.8 MANAGEMENT OF HIV
A person having HIV does not necessarily mean he has AIDS. AIDS is an advanced stage of HIV. The Centre for Disease Control (CDC), Atlanta, USA, uses specific criteria for determining when a person living with HIV progresses to AIDS. If a person’s T cell count falls below 200 T4 cells, then he/she has officially progressed to AIDS. Also, if an HIV+ individual is diagnosed with an opportunistic infection that’s included on the CDC’s list of over two dozen possible HIV-related Ois, then he/she is diagnosed with AIDS (CDC, 1996).
The management of the disease involves self-management or managing by ART. The signs and symptoms of HIV like weight loss, diarrhoea, fever, etc., can be easily managed by individuals themselves by consuming a nutritious diet, maintaining hygienic conditions, by keeping oneself well-informed and by avoiding the high-risk behaviour. PLHIV are often given ART for slowing the progression of the disease. Anti-retroviral drugs (ARVs) are not required by all PLHIV at all stages. WHO (2007) recommends that the optimum time to commence ART is prior to the patients becoming unwell or presenting their first opportunistic infection (Table 2.6). Initiation of ART is recommended for all patients with pulmonary TB or severe bacterial infections and CD4 counts <350cells/mm³. Initiation of ART is also recommended for all pregnant women with any stage 3 disease and CD4 count <350cells/mm³.

<table>
<thead>
<tr>
<th>WHO clinical stage</th>
<th>CD4 count available</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Treat if CD4 &lt;200cells/mm³</td>
</tr>
<tr>
<td>2</td>
<td>General principles:</td>
</tr>
<tr>
<td></td>
<td>• Consider treatment if CD4 count &lt;350cells/mm³ but initiate before CD4 count drops below 200 cells/mm³</td>
</tr>
<tr>
<td>3</td>
<td><strong>In case of pregnancy or TB</strong></td>
</tr>
<tr>
<td></td>
<td>• Start ART in all HIV-infected pregnant women with WHO Stage 3 disease and CD4 count &lt;350 cells/mm³</td>
</tr>
<tr>
<td></td>
<td>• Start ART in all HIV-infected patients with CD4 count &lt;350 cells/mm³ and pulmonary TB (WHO Stage 3) or severe bacterial disease</td>
</tr>
<tr>
<td>4</td>
<td>Treat irrespective of CD4 count (extra-pulmonary TB is WHO Stage 4 disease)</td>
</tr>
</tbody>
</table>

(Source: WHO, 2007)

There are two classes of commonly-used ARVs – reverse transcriptase inhibitors (RTIs) and protease inhibitors (PI’s). A third class of ARV, fusion inhibitors, is seldom used. Castleman et al (2004) described the first class of ARV, the reverse transcriptase inhibitors, which operate early in HIV lifecycle to stop viral replication after HIV has infected a cell. Two types of these drugs exist: non-nucleoside reverse transcriptase (NNRTIs) which bind onto the reverse transcriptase enzyme and prevent the HIV RNA from converting into DNA (e.g. efavirenz, nevirapine) and the second is nucleoside/nucleotide reverse transcriptase inhibitors (NRTIs) which incorporate into the viral DNA and prevent it from producing copies of the virus (e.g. lamivudine, zidovudine, stavudine). The second class of ARV operates later in the lifecycle of HIV. These drugs stop the protease enzyme from assembling the new HIV material to be released to infect other cells (e.g. indinavir, saquinavir). ART involves the administration of more than one ARV. This is referred to as combination therapy or highly active antiretroviral therapy (HAART).
NACO (2008) has defined the first-line and second-line ART regimen as follows –

**First line regimen** – First-line ART is the initial regimen prescribed for an ART naïve patient when the patient fulfils national clinical and laboratory criteria to start ART. It recommends two classes of drugs for initial treatment ie 2 NRTI + 1 NNRTI.

**Second line regimen** – Second-line ART is the next regimen used in sequence immediately after firstline therapy has failed. NACO recommends that the protease inhibitor (PI) class is reserved for, and therefore characterizes second-line ART.

The National ART regimen as per NACO (2008) is shown in Table 2.7.

**Table 2.7: National ART Regimen (India)**

<table>
<thead>
<tr>
<th>National ART Regimen</th>
<th>Regimen</th>
<th>Remarks</th>
<th>To be made Available at</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regimen I</td>
<td>Zidovudine + Lamivudine + Nevirapine</td>
<td>“Preferred regimen”</td>
<td></td>
</tr>
<tr>
<td>Regimen I (a)</td>
<td>Stavudine* + Lamivudine + Nevirapine</td>
<td>For patients with Hb &lt; 8 gm/dl</td>
<td>All ART centers</td>
</tr>
<tr>
<td>Regimen II</td>
<td>Zidovudine + Lamivudine + Efavirenz</td>
<td>preferred for patients on anti-tuberculosis treatment and Hb &gt; 8gm/dl</td>
<td></td>
</tr>
<tr>
<td>Regimen II (a)</td>
<td>Stavudine* + Lamivudine + Efavirenz</td>
<td>for patients on anti-tuberculosis treatment and Hb &lt; 8 gm/dl</td>
<td></td>
</tr>
<tr>
<td>Regimen III</td>
<td>Tenofovir + Lamivudine + Nevirapine</td>
<td>For patients not tolerating ZDV or d4T on a NVP-based regimen</td>
<td>Refer to SACEP for decision. Drug supply mechanism to be decided.</td>
</tr>
<tr>
<td>Regimen III (a)</td>
<td>Tenofovir + Lamivudine + Efavirenz</td>
<td>For patients not tolerating ZDV or d4T on an ETV-based regimen</td>
<td></td>
</tr>
<tr>
<td>Regimen IV</td>
<td>Zidovudine + Lamivudine + Lopinavir/Ritonavir</td>
<td>For patients not tolerating both NVP and EFV, and Hb &gt; 8gm/dl</td>
<td>Centers of excellence</td>
</tr>
<tr>
<td>Regimen IV (a)</td>
<td>Stavudine + Lamivudine + Lopinavir/Ritonavir</td>
<td>For patients not tolerating both NVP and EFV and Hb &lt; 8 gm/dl</td>
<td></td>
</tr>
<tr>
<td>Regimen V</td>
<td>Tenofovir + Lamivudine + Lopinavir/Ritonavir + Zidovudine</td>
<td>preferred</td>
<td></td>
</tr>
<tr>
<td>Regimen V(a)</td>
<td>Tenofovir + Lamivudine + Lopinavir/Ritonavir</td>
<td>for patients with anemia &lt; 8 gm/dl</td>
<td></td>
</tr>
</tbody>
</table>

(“only Stavudine 30mg based regimen are to be used”)

2.9 QUALITY OF LIFE IN PEOPLE LIVING WITH HIV/AIDS
Quality of life is an important factor for mental health and illness and variety of researches have been carried out to explain it. Quality of life refers to the degree of excellence in one’s life
at any given period of time that contributes to satisfaction and happiness of the person and benefits the society (Tiwari et al, 2009). It tends to cover a variety of areas such as physical, material, psychological, social and spiritual well-being. WHO (2002) defines quality of life as individuals’ perceptions of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns.

Quality of life is a multi-dimensional concept whose definition and assessment remains controversial (Susan et al, 1999). Several researchers described Quality of life as a “fighting spirit” associated with longer survival time for individuals (Rabkin et al, 1993; Lesserman et al, 1992; Namir et al, 1990). Quality of life relates both to adequacy of material circumstances and to personal feeling about these circumstances. It includes overall subjective feeling of well being that are closely related to moral, happiness and satisfaction (Mc Dowell and Newell, 1987). Further as health is generally cited as one of the most important determinants of overall quality of life, it has been suggested that quality of life may be uniquely affected by specific disease process such as AIDS (Watchel et al, 1992).

Handford et al, (2006) reported that comprehensive treatment strategies and providing various and consecutive care methods including physical and mental rehabilitation services and home care can improve the disease outcome, and have a desirable effect on the quality of life of the HIV patients. Figure 2.6 shows the four major domains of quality of life which are often affected in HIV/AIDS as cited in different studies (Basavaraj et al, 2010).

![Figure 2.6: Quality of Life Domains](image)

*Figure 2.6: Quality of Life Domains*
HIV/AIDS patients struggle with numerous psychosocial problems such as stigma, poverty, depression, substance abuse and culture beliefs which can affect their quality of life not only from physical health aspect, but also from mental and social health point of view and cause numerous problems in useful activities and interests of the patients (Aranda-Naranjo, 2004). HIV infection and psychiatric disorders present a complex relationship and have received special attention in the last decade, considering their impact in the personal, sexual, social and occupational lives of people living with HIV/AIDS (Chandra et al, 2005). Among the various psychiatric disorders frequently identified in people living with HIV/AIDS, depression is the most prevalent. Apart from depression, it has been observed that stressful life events are associated with increased progression of the HIV/AIDS infection (Evans et al, 1997) which in turn, increase from three to five times the risk of developing depression (Mello and Malbergier, 2006). It has been well established that HIV/AIDS infection compromises the quality of life of the sufferer (Evans et al, 2002). Stressful events and social support relate to HIV disease progression towards AIDS (Coleman and Holzemer, 1999). The three important components of social support identified are emotional, tangible and informational support (Leserman et al, 1992).

Comorbid psychiatry illness including depression are common in HIV infected individuals (Kelly et al, 1998). Wagener et al, (1996) and Kelly et al, (1998) reported that depression among HIV patients has ranged from 22 – 38 percent. Also, patients older than 35 years are more likely to suffer from depression, anxiety, confusion and fatigue (Hoffman, 1997). Impact of depression on health-related quality of life has been well documented in various studies (Selwyn and Arnold, 1998; Bettinger, 1997; Voelker, 1997). Treatment of depression in HIV infected adults may not improve the lifespan but can lower the risk of suicide or improve the quality of life (Banks, 1995).

Friedland et al (1996) examined coping, social support and QOL among PLHIV and reported that their positive status had an almost neutral effect on QOL and several areas like income, emotional, social support, and problem-oriented and perception oriented coping were positively related to QOL. Various studies have demonstrated a strong association between HIV and emotion disturbance (Trepanier et al, 2005; Davis, 2004; Linsk and Mason, 2004; Chandra et al, 1998). Lack of mental peace and depression widely affect the quality of life and day-to-day functioning of a person (Chandra et al, 1998) and may even lead to failure of HAART (Cheer and Goa, 2001). Therefore, it is important for physicians to address this problem using the available treatment options (Phillips et al, 2004).

Socio-demographic characteristics such as male gender (Mannheimer et al, 2005), younger age (Ruiz et al, 2005), higher socio-economic status (Swindells et al, 1999) and employment (Swindells et al, 1999) have been associated with improvement in QoL. Other variables such
as lower HIV viral load (Ruiz et al, 2005a), greater CD4 cell count (Ruiz et al, 2005a; Ruiz et al, 2005b; Jia et al, 2005), fewer or less bothersome HIV symptoms (Murdagh et al, 2006) and higher levels of haemoglobin have been shown (Semba et al, 2005) to be important clinical/ immunological indicators for better QoL. In addition, patients with no difficulty in taking medicines (Ruiz et al, 2005b), those using regimens with lower number of pills (Ruiz et al, 2005a) and those more adherent to ART (Ruiz et al, 2005a; Mannheimer et al, 2005; Swindells et al, 1999) tend to have improved QoL. Fatigue or low energy has been associated with physical and psychological morbidity (Breitbart et al, 1998) and poor QoL (Zinkernagel et al, 1999). Spirituality among HIV positive individuals is perceived as a bridge between hopelessness and meaningfulness in life.

Study by Saunders et al (2002) stated that patients with better immunologic/virologic outcomes showed improvements in mean QOL ratings, while those with poorer clinical outcomes showed deterioration in their overall QoL scores. Wig et al, (2006) studied the impact of HIV/AIDS on the quality of life of HIV positive patients in Northern India. They concluded that QOL is associated with education, income, occupation, family support and clinical categories of the patients. Ostrow et al (2006) reported that the QOL of HIV positive participants was dynamic over the HIV disease course. HIV infection deteriorated physical but not mental QOL. HAART enhanced mental health functioning. Zimpel et al (2007) tested psychometric properties of the Brazilian version of the WHOQOL-HIV. The QOL of 308 HIV-infected men and women were assessed in the different HIV disease severity stage. They reported that women, younger (<35 years) and married patients were associated with a lower QOL.

### 2.10 NUTRITION AND HIV/AIDS

Nutritional intake is often an overlooked factor in the progression of HIV disease, although the relation between nutrition and immune function is well established (Kim et al, 2001). Even in populations not infected with HIV poor nutritional status is known to impair the immune response (Katona and Apte, 2008; Coodley et al, 1993). The effect of HIV on nutrition begins early in the course of the disease, even before an individual may be aware of the infection. In HIV-infected individuals, poor nutritional status is a strong predictor of survival, even after controlling for CD4+ cell counts (Suttman et al, 1995; Semba et al, 1995): a weight loss of more than 66% of ideal body weight was linked to the timing of death in AIDS patients (Kotler et al, 1989).

Nutrition and HIV are closely linked. A good nutritional status is when the body has enough of the right kinds of foods and nutrients to meet its requirements for proper functioning, growth, repair and maintenance of health. Any immune impairment as a result of HIV/AIDS can contribute to malnutrition because of recurrent infections and diseases. Malnutrition, on the other hand, contributes to a weakened immune system, which worsens the effect of HIV.
infection can also lead to nutritional deficiencies through decreased food intake, malabsorption and increased utilization and excretion of nutrients, which, in turn, hasten the onset of AIDS (Semba and Tang, 1999). Timely improvement in nutritional status can help strengthen the immune system thereby reducing the incidence of infections, preventing loss of weight and lean body mass and delaying disease progression. Some nutritional deficiencies can be reversed by timely and adequate nutritional therapy.

2.10.1 Relationship between HIV/AIDS and Malnutrition
There exists a “vicious cycle” between HIV/AIDS and nutrition as shown in Figure 2.7. HIV impairs the immune system making the body vulnerable to various infections. To cope with HIV and other infections the need for energy and other nutrients is increased. If these increased needs are not met, malnutrition results. Malnutrition, on the other hand, contributes to a weakened immune system, which worsens the effect of HIV. This leads to rapid progression to AIDS. Malnutrition, therefore, can both contribute to and result from HIV infection.

![Figure 2.7: Cycle of good nutrition and resistance to infection in the context of HIV/AIDS](Source: WFP and TANSAC, 2007)

Around half of all pre-school child deaths in developing countries are attributable to the negative synergy of malnutrition and infectious disease, with the majority of deaths complicated by mild-to-moderate undernutrition (Pelletier et al, 1995). Both protein-energy and micronutrient deficiencies are associated with significant defects in cell-mediated and humoral immunity, depressed cytokine production and decreased phagocyte function (Tomkins and Watson, 1989). Infections are thus more long-lasting and more severe in someone who is malnourished. They may also become frequent.

2.10.2 Impact of HIV/AIDS on Nutritional Status
Nutrition plays a crucial role throughout the course of HIV disease. The links between nutrition and HIV/AIDS amplify the negative effects of HIV infection on human development at individual, household, community and national levels (Colecraft, 2008).
Weight Loss and Wasting
Unintentional weight loss of more than 10 percent of baseline in 30 days is considered as HIV-associated wasting according to Center for Disease Control and Prevention (1987). “Cachexia” describes a preferential loss of Lean Body Mass (LBM), which implies metabolic derangement rather than a nutrient deficiency (Nelson et al, 1994) while “wasting” is a less precise term that suggests weight loss due to inadequate nutrient intake (Kotler, 2004; Wanke, 2004). Weight loss and depletion of lean body mass (LBM) are early indicators of malnutrition in PLHIV. HIV infection may result in weight loss and wasting through three major routes i.e. poor intake, increased nutrient losses, metabolic changes and increased nutrient requirements (Mathew M, 2004).

- **Depressed appetite, poor nutrient intake and limited food availability or Inadequate oral intake:** HIV is associated with factors such as loss of appetite, gastrointestinal complications and oral and oesophageal sores that affect the individual’s desire for food and ability to eat, leading to inadequate dietary intakes (Suttajit, 2007). Sharkey et al, (1992) evaluated nutritional status and food intake and found that overall HIV-infected patients were thinner as compared to the seronegative population. Also, no differences were reported in food intake between the groups. Another study by Dworkin et al, (1990) compared nutritional intake in clinically stable patients with AIDS, patients with AIDS-related complex, and asymptomatic HIV-infected controls. It also reported no differences in oral intake among the three groups during the 72-hour recording period. Kotler et al, (1990) found no difference in weight as percent of ideal between clinically stable patients with AIDS and homosexual or heterosexual HIV-seronegative patients, although body cell mass, as determined by total body potassium, was significantly reduced in the patients with AIDS.

Studies evaluating oral intake in HIV-infected patients with acute opportunistic infections have also found significant reductions in caloric intake. During weight loss episodes, total energy expenditures were reduced, primarily related to reductions in activity (Macallan et al, 1995; Grunfeld et al, 1992). However, evaluation of energy intake showed that the reduced oral intake exceeded the reduction in total energy expenditures. These studies suggest that, in patients with AIDS, acute systemic infections cause significant reductions in oral intake and play the major role in short-term weight loss. Li et al (2011) reported that in PLHIV receiving ART the phenomenon of weight loss continues and CD4 count, haemoglobin, reduced dietary intake, nausea/vomiting were found to be the contributing factors.

Chronic infection, malabsorption, metabolic disturbances and muscle and tissue catabolism: HIV-related chronic diarrhoea is frequently accompanied by weight loss, particularly in those with more severe reductions in CD4 count (Boniphace et al, 2011). Chronic weight loss and malabsorption in HIV is often related to gastrointestinal diseases which causes severe diarrhoea or HIV enteropathy. PLHIV with more severe malabsorption have lower
body weights. Evaluation of gastrointestinal function in these patients has documented reductions in D-xylose and fat absorption (Paltiel O et al, 1995; Carlson et al, 1994; Ehrenpreis ED et al, 1992). The degree of fat malabsorption in some patients with diarrhea may be striking (i.e., >20 g/day) (Cello et al, 1991). In one study, 48 serum carotene, a marker of fat malabsorption, was decreased in 77 percent of HIV-infected patients and was associated with a decreased CD4 count. Vitamin B12 deficiency, which may be detected in 10-20 percent of patients with AIDS (Paltiel O et al, 1995; Ehrenpreis ED et al, 1994) has been considered the result of intestinal malabsorption. Protein exudation may contribute to hypoalbuminemia, which is common in patients with AIDS (Huang et al, 1998). Pancreatic insufficiency does not seem to be the cause of fat malabsorption in patients with AIDS with diarrhea (Kapembwa MS et al, 1990).

In patients with diarrhea, abnormalities of small bowel morphology include chronic inflammation and variable degrees of villous flattening, which may be accompanied by malabsorption (Bhaijee et al. 2011; Kotler et al, 1993; Lim et al, 1993;Church et al, 1992; Greenson et al, 1991; Madi et al, 1991). Poles et al (2001) reported that 90 percent of HIV positive individuals have fat malabsorption leading to diarrhea and ultimately weight loss.

The normal response to malnutrition caused by fasting is a reduction in metabolic rate (resting energy expenditures) (Grunfeld et al, 1992). In contrast, patients with severe acute infections and PLHIV have an increase in metabolic rate (Grunfeld et al, 1992; Hommes et al, 1990; 1992). Although smaller studies have reported a decrease in metabolic rate in stable patients with AIDS, those with systemic infections maintain an increased metabolic rate despite decreased caloric intake, similar to patients with sepsis, burns, or major trauma (Dworkin et al, 1990; Stein et al, 1990). Most studies have documented an increase in resting energy expenditures depending on the stage of immunodeficiency (denoted by the CD4 count) and the presence of active infections (Macallan et al, 1995; Grunfeld et al, 1992; Hommes et al, 1990;1991). The resting metabolic rate in HIV-infected patients with a normal CD4 count was 8 percent greater than observed in a group of HIV seronegative patients (Hommes et al, 1991). Compared with healthy controls, patients with AIDS and active infections had a 34 percent increase in metabolic rate; stable patients with AIDS were found to have a 21 percent increase (Melchior et al, 1993). Grunfeld et al (1992) measured resting energy expenditures and caloric intake in HIV-infected patients and normal subjects.

The pattern of weight loss may vary, depending on the patient’s clinical manifestations of HIV infection. Acute weight loss may occur before or during acute infections or may occur as a preterminal event (Macallan et al, 1993; Hoover et al, 1992). In contrast, patients with chronic progressive weight loss were more likely to have a gastrointestinal complication, particularly a diarrheal illness.
These data in aggregate suggest that, even in early HIV infection, resting energy expenditures may be mildly increased although weight remains stable. In the absence of opportunistic infections, patients with AIDS may maintain a stable weight despite an increase in resting energy expenditures by appropriately increasing caloric intake and/or decreasing activity. An acute systemic illness seems to cause weight loss primarily through significant reductions in oral intake, although increased energy expenditures play an important role. Progressive weight loss seems to be more characteristic of patients with gastrointestinal complications in whom decreased oral intake and malabsorption may occur. In patients with multiple simultaneous infections (e.g., P. carinii pneumonia and intestinal cryptosporidiosis), weight loss may result from multiple pathophysiological mechanisms.

- **Endocrine dysfunction:** Disturbances in a variety of endocrine systems have been documented in patients with AIDS. A reduction in serum testosterone hormone concentration, adrenal dysfunction, and an alteration in thyroid hormone levels have been documented (Coodley et al, 1994) especially in patients with severe wasting, although not consistently (Hommes et al, 1991; 1990). However, it is unclear whether these hormonal aberrations are causally related to wasting. Grunfeld et al (1993) found that thyroid hormone concentrations were normal in asymptomatic HIV-infected patients but decreased appropriately in those with systemic illnesses. In addition, for those with acute infections, anorexia, and weight loss, reduction in T3 concentrations occurred. In these patients, the resting energy expenditures were greater than in asymptomatic patients or normal individuals. These studies taken together suggest that endocrine dysfunction plays a minor role, if any, in HIV-related wasting.

- **Psychosocial factors:** Psychological disturbances like mental illness, depression and personal beliefs and other sociological factors like poverty, family and food insecurity amplify and complicate malnutrition and effects of HIV.

  Food insecurity occurs more often in PLHIV as the majority of HIV infections occur in the most productive section of the population, which is amongst adults aged 15-49 (FAO, 2003). As PLHIV become unwell, work participation and income generating capacity decreases, leading to lower household incomes and less money available for food particularly when medical costs increase at the same time (Lemke, 2005; Stover and Bollinger, 1999). Declining health and mobility can also impact on an individual’s ability to access a reliable food supply, depending on the availability of social supports.

  Personal religious and cultural beliefs may prohibit the consumption of certain foods and influence decision making around food and treatments. Beliefs about the curative powers of certain foods and herbal therapies may prevent achievement of optimal nutritional status, either by refusal to take ART when necessary or replacing nutritious foods with nutritionally inadequate foods or supplements (Fields-Gardner et al, 2004).
Weight loss in PLHIV follows two patterns: slow and progressive weight loss from anorexia and gastro-intestinal disturbances; and rapid, episodic weight loss from secondary infections. Even relatively small losses in weight (5%) have been associated with decreased survival in PLHIV and are therefore important to monitor (Macallan DC, 1999).

Weight loss and depletion of lean body mass are early indicators of malnutrition in PLHIV. Unlike simple starvation, which depletes the fat first, wasting in HIV infection takes a much greater toll on muscle mass. Wasting, particularly loss of lean tissue and muscle protein mass (Yarasheski et al, 1998), has been associated with increased mortality (Melchior et al, 1999; Wheeler et al, 1998), accelerated disease progression (Wheeler et al, 1998), and impairment of strength and functional status (Grinspoon et al, 1999) in patients with HIV infection.

Weight loss is associated with significant morbidity and mortality in populations living with HIV/AIDS. After controlling CD4 counts and age, Guenter et al, (1993) reported an 8.3 fold increased risk of death with a weight <90 percent of the ideal body weight in HIV-seropositive individuals. Wheeler et al (1998) also reported increased risk of death with progressive weight loss. The risk of death rose from 1.26 with a weight loss of 0-5 percent over four months to 2.22 with a weight loss of 5-10 percent over four months. Kotler et al (1989) predicted that when the weight falls to 66 percent of the ideal body weight, death becomes a near certainty. Hospitalization usually occurs when there is a 20 percent loss in weight in the presence of opportunistic infections (Edwards, 2006).

In HIV disease, anthropometric measurements provide an inexpensive and non-invasive means to monitor long-term nutritional status, characterized body fat deposition and assist in screening for nutritional risk (Batterham et al, 1999).

**Body Mass Index (BMI)**

Malnutrition (referring to protein-energy malnutrition) in adults is often recognized by body measurements and BMI is one of the techniques to identify malnutrition in adults. BMI is recognized as an indicator for chronic energy malnutrition (Ferro-Luzzi et al, 1992) and is often lower for PLHIV and those who are HIV negative (Hogg et al, 1995; Schwenk et al, 1993). BMI is also considered as an important predictor of survival of PLHIV (Ndekha et al, 2009; Vander et al, 2004; Dannhauser et al, 1999). A study by Thiebaut et al, in 2000 revealed that a low BMI (16-18.4kg/m²) was associated with a 2.2-fold (95% CI, 1.6-3.0) increased risk of death, whereas a BMI of <16 kg/m² was associated with a 4.4-fold (95% CI, 3.1-6.3) increased risk of death. Similarly, a West African cohort study has shown that baseline BMI recorded within 3 months of the diagnosis of HIV infection is a strong and independent predictor of mortality (Vander et al, 2004). Median survival for patients with a BMI below 16 was only 0.8 years compared to 8.9 years for individuals with a BMI above 22 at baseline (p<0.0001), after
adjusting for CD4 cell count at baseline, age, sex, opportunistic infection and receipt of PCP prophylaxis (Vander et al, 2004). A study by Shor-Posner (2000) found that body mass index (BMI) is inversely associated with progression to death independent of CD4 count among HIV-positive drug users.

Due to the advent of antiretroviral drug therapy (ART) and subsequent improved life expectancy, HIV has become a chronic disease. There are studies conducted across the globe that report the prevalence of obesity and overweight among PLHIV. In the Nutrition For Healthy Living (NFHL) cohort in 1998, 27 percent of women were found to be overweight and 21 were obese while 33 percent of men were overweight and 6 percent were obese (Shevitz et al, 2001). Hodgson found a high prevalence of obesity among HIV patients, with 34 percent overweight and 9 percent being obese (Hodgson et al, 2001). Kristy et al (2006) mentioned in paper that the obesity is growing into a common problem among people infected with HIV which suggests the need for physicians and nutritionists to be consistent with current recommendations for dietary intake of total fat, saturated fat, and fiber.

Biochemical Derangements
The impaired immune functions resulting from lack of essential micronutrients have been called nutritionally acquired immune deficiency syndrome, or NAIDS (Beisel, 2001). NAIDS may contribute to the depletion and dysfunction of CD4+ cells but also makes the host susceptible to other infections which may increase viral replication and hence quicken HIV progression (Whalen et al, 2000). Excessive urinary losses and low blood concentrations of vitamins A, B2, B6, B12, C, E as well as folate, beta-carotene, selenium, zinc and magnesium, which are needed by the immune system to fight infection are commonly observed in PLHIV (Bogden et al, 1990). Deficiencies of such antioxidant vitamins and minerals contribute to oxidative stress, which is believed to increase the rate of HIV replication (Romero-Alvira et al, 1998). The effect of micronutrient deficiencies on viral load of the HIV-positive individual and its systemic or local effect in genital secretions and breast milk, thus overall affecting both HIV progression and infectivity is pictorially shown in Figure 2.8 (Friis, 2005).
• Anaemia (Deficiency of Iron): Anaemia accelerates disease progression and increases mortality among HIV-infected individuals. The aetiology of anaemia in HIV infection is multifactorial and typically the anaemia results from underproduction of red blood cells. Frequently the laboratory features are compatible with anaemia of chronic disease with a low reticulocyte count, normocytic and normochromic red blood cells with normal iron stores and cytokine mediated poor erythropoietin response (Spivak, 2000; Kreuzer et al 1997; Groopman 1990).


The treatment of HIV patients with the HAART has generally been taken as the gold standard in the management of HIV patients (Odunukwe et al., 2005). HAART have been reported to improve haematocrit and haemoglobin values as well as result in significantly reduction
in morbidity and mortality of HIV patients (Odunukwe et al., 2005; Gea – Banacloche and Lane, 1999). On the other hand, the use of HAART has also been reported to cause mild to moderate anaemia (Mildvan, 2003) and some authors report no improvement in haematocrit values of HAART treated HIV patients when compared with their HAART naive counterparts (Omoregie et al, 2008).

- **Other Micronutrients**: Deficiencies of vitamins and minerals such as vitamin A, B-complex, Ce and E and selenium and zinc, which are needed by the immune system to fight infection, are common in people living with HIV (Kupka and Fawzi, 2002; Semba and Tang, 1999). Deficiencies of anti-oxidant vitamins and minerals contribute to oxidative stress, a condition that may accelerate immune cell death (Banki et al, 1998; Romero and Roche, 1998) and increase the rate of HIV replication (Allard et al, 1998; Schwarz, 1996; Rosenberg and Fauci, 1990).

- **Beta Carotene** — Low serum and plasma beta carotene and other carotenoids (including lutein and lycopene) have been observed in multiple studies in both HIV-positive and AIDS patients (Lacey et al, 1996; Tomaka et al, 1994; Ullrich et al, 1994). Depression of serum beta carotene levels is usually indicative of fat malabsorption and diarrhoea, common complications of AIDS, secondary to general malabsorption, infection, and altered gut barrier function (Keating et al, 1995). Favier et al (1994) found severe deficiencies of plasma carotenoids and beta carotene in groups with mean CD4 count of 396mm3 and 56mm3 respectively. Semba et al (1995) reported that low plasma vitamin A levels in HIV infected adults in US were associated with significantly higher risks of death.

- **Selenium** – Selenium is required for the activity of the enzyme glutathione peroxidase — a key mediator of oxidant stress. Selenium deficiency is associated with immune dysfunction, impaired resistance to microbial and viral infections, inadequate phagocytosis and antibody production and decreased CD4 cell numbers (Kiremidjian and Stotzky 1985). Selenium deficiency may be instrumental in cardiomyopathy, skeletal myopathy, anemia, increased cancer risk, and oral candidiasis (Dwarkin 1994). Selenium deficiency, more than any other micronutrient, has been documented to correlate with progression and mortality of HIV (Baum et al, 1997) and incidence of opportunistic infections (Shor-Posner et al, 2002). Selenium deficiency has been documented in both HIV and AIDS patients in both plasma and red blood cells (Baum et al, 1997; Look et al, 1997; Dworkin, 1994).

- **Zinc** – In observational studies of HIV-infected adults, low levels of serum zinc have been related to HIV disease progression (Graham, 1991), decreased CD4 cell counts (Baum, 2003) and increased mortality (Baum 2003; Baum 1997), and low dietary intake has been associated with decreased survival (Baum 2003). Baum (1995) reported in a follow-up study that among HIV positive men normalization of serum zinc levels were associated with higher CD4 cell counts.
• **Vitamin D:** A number of studies done in US reported that deficiency of Vitamin D is common among PLHIV and is associated with renal insufficiency and recommended the screening of all PLHIV for Vitamin D deficiency or insufficiency (Dao et al, 2011; Rodríguez et al, 2009; Villamor 2006). Similar results were reported by studies done in Netherlands (Van Den et al, 2008) and Japan (Nakamura, 2006).

• **Others:** A study by Periquet et al (1995), reported that significant deficiencies for lycopene, retinol, tocopherol (p<0.05) and transthyretin and serum albumin (p<0.01) occurred at non-AIDS stage as compared to those having AIDS. Levels of copper and long-chain polyunsaturated fatty acids were higher by 40 percent and 21 percent respectively in the non-AIDS group than the controls. High-density lipoprotein cholesterol and total cholesterol, haemoglobin, albumin and triglycerides were found to be significantly lower in HIV-infected subjects. They also had higher globulin and liver enzyme levels than uninfected subjects (Vorster et al, 2004). A study by Baum and Posner (1998) indicated that impaired nutritional status (overly low levels of prealbumin), and deficiency of vitamin A, vitamin B12, zinc and selenium in HIV-positive patients was significantly associated with mortality while B6 and vitamin E deficiency was not associated with mortality.

**Lipodystrophy**

Lipodystrophy is a loss of subcutaneous adipose tissue from the face and peripheral regions, particularly the extremities (Kotler et al, 1999; Panse et al, 2000). Some patients have concomitant deposition of excess adipose tissue around the neck (double chin), over the dorsocervical spine (buffalo hump) (Ionescu et al, 2000; Mercie et al, 2000; Thiebaut et al, 2000), upper torso and intraabdominal region (Ionescu et al, 2000; Panse et al, 2000; Falutz et al, 1999). Breast enlargement has been observed in both women (Thiebaut et al, 2000) and men (Donovan et al, 1999), but whether it is due to excess of subcutaneous fat, glandular hypertrophy, or both is not clear. Compared with men, peripheral fat loss in women is often more subtle, whereas increased truncal adiposity is the main complaint (Falutz et al, 1999).

Saghayam et al (2004) reported that with an increase in number of people in India are on ART, the average lifespan increases leading to morphological changes like loss of buccal or limb fat. Kalyanasundaram (2011) reported the prevalence of lipodystrophy in South India as high as 60 percent in people attending the ART centre. Another study from Western India by Pujari et al (2005) reported the prevalence of lipodystrophy as 46 percent. International studies also report high prevalence of lipodystrophy among PLHIV undertaking HAART (Ceccato et al, 2011; Van Griensven et al, 2007; Miller et al, 2003).

Patients with lipodystrophy are often found to have dyslipidemia, impaired glucose tolerance and insulin resistance (Kotler, 2008; Falutz 2007; Koppel et al, 2000). These indicate that those showing signs of lipodystrophy are also at an increased risk of developing cardiovascular diseases at a later stage (Kotler, 2008).
2.10.3 Nutritional Assessment of People Living with HIV/AIDS

From the onset of the disease, HIV infection places a strain on the body leading to malnutrition and wasting. A nutritional assessment should thus be conducted for all patients irrespective of the stage of HIV disease in order to assess status and identify potential problems promptly (Padmapriyadarsini and Swaminathan, 2004). Shevitz (2001) has coined nutritional assessment for PLHIV in the mnemonic “ABCD” which stands for anthropometric, biochemical, clinical and dietary parameters.

**Anthropometric Data**

Weight loss is associated with adverse outcomes in PLHIV therefore regular monitoring of weight and BMI are essential (Wheeler et al, 1998). Maserati et al (2007) and Knox et al (2003) also reported that weight and BMI are the most common anthropometric measurements taken to assess the nutritional status of PLHIV. However, Paton et al (1999) reported that alone body weight could not measure the loss of body cell mass therefore, this should be complemented with measurements of body compartments like body fat, skeletal muscle, total body water, etc. Mid-arm circumference and triceps skinfold thickness should be measured every six months as well. This will help in longitudinal tracking of patients. A practical method for assessing fat redistribution is measurement of the waist and hip circumference and the waist-hip-ratio (Rexrode et al, 1998).

**Biochemical**

Measurements of serum proteins and micronutrients help to predict the outcome of HIV and also identify correctable deficiencies, therefore, they are the most common parameters studied (Baum et al, 2000). Also, common measurements taken are of albumin and pre albumin transferring/total iron and percent saturation, vitamin B12/folate, trace elements, CD4 and CD8 immune cells and HIV viral load, CBC with differential count, electrolytes, liver and renal functions. The levels of zinc and albumin are also studied as they may decrease rapidly during periods of stress due to infection and quickly increase when the infection is cured(Feldman et al, 2003; Salomon et al, 2002). The priority timeline for referral of patients categorized by nutritional risk is that those having High risk need to see the dietician within one week; those at moderate risk in one month and those at low risk may meet the dietitian as and when required (Fenton et al, 1998; Heller et al, 1998).

**Clinical history**

Clinical assessment includes a medical history and a physical examination to identify signs of or contributors to malnutrition. Key areas in the clinical assessment include physical appearance, evaluation of opportunistic infections and comorbid conditions, occurrence of diarrhea, symptoms of gastrointestinal distress or malabsorption, medications, use of nutritional or herbal supplements, and functional status. Assessment of social, psychological, and financial
resources that may affect an individual’s ability to obtain, prepare, and eat food are as important as the medical assessment in evaluating nutritional risk factors (Knox et al, 2003). Many studies included antiretrovirals, any medication for the treatment of OI’s, use of vitamins/minerals, and alternative therapies such as herbs, e.g. didanosine needs to be taken on an empty stomach; or avoiding iron supplements with dairy products into clinical assessment of PLHIV (Hui, 2003; Leow et al, 2003 and Tanwani et al, 2003; Means, 1997).

**Detailed Diet History**
This includes food frequency and/or 24-hour recall. Special attention is paid to food intolerances, feeding skills and developmental milestones as well as any nutritional supplements (liquid products used to increase the caloric intake) (Coodley, 1995).

**2.10.4 Nutrient Requirements for People Living With HIV/AIDS**
The nutrient requirements for PLHIV have been given by WHO (2003). It states that Adequate nutrition, which is best achieved through consumption of a balanced healthy diet, is vital for health and survival for all individuals regardless of HIV status.

**Energy**
Changes in energy intake and metabolism in PLHIV have been reported by various studies. Most studies in adult patients show that RMR is around 10% higher than in control groups (Grinspoon et al, 1999, 1998; Macallan et al, 1995; Melchior et al, 1993, 1991; Grunfeld et al, 1992; Hommes et al, 1991, 1990). RMR is highest in those with the most severe disease. In particular those with secondary infection had higher RMRs (Tomkins, 2002) than did patients without secondary infection (Melchoir et al, 1993; Grunfeld et al, 1992). As total daily energy expenditure (TDEE) includes three components: RMR, physical activity and diet-induced thermogenesis in adults and an additional allowance for growth in children. While RMR is often increased in HIV/AIDS TDEE does not necessarily increase because physical activity may be reduced because the patient feels too ill to get up and work. Indeed TDEE was decreased among men with HIV/AIDS during rapid weight loss, mainly because physical activity was reduced (Sheehan et al, 2000; Macallan et al, 1995).

Based on increased resting energy expenditure (REE) observed in studies of HIV-infected adults, it is recommended that energy needs be increased by 10 percent over accepted levels for otherwise healthy people. The goal is to maintain body weight in asymptomatic HIV-infected adults (WHO, 2003). Increased energy intake of about 20 percent to 30 percent is recommended for adults during periods of symptomatic disease or opportunistic infection to maintain body weight. This takes into account the increase in REE with HIV-related infections. Intakes should therefore be increased to the extent possible during the recovery phase, aiming for the maximum achievable up to 30 percent above normal intake during the acute phase.
Protein
A frequently asked question is - Do HIV-positive individuals need to eat more protein or a different proportion of protein in their diet? A clinical state of protein depletion suggests that greater amounts of dietary protein are required. However much evidence from animal and human studies models in septic or catabolic states similar to HIV/AIDS shows that increased levels of amino acid or protein intake are not utilized adequately (Powell et al, 1994; Tomkins et al, 1983). Fat is usually lost first and as body fat stores become progressively depleted, more lean body mass is lost per kilogram of total weight loss. But HIV seems to induce a special metabolic effect in the host involving a preferential loss of protein over fat (Harrison et al, 2002; Macallan, 2001; 1999; 1998). Loss of protein mass is markedly accelerated during opportunistic infections (Macallan et al, 1995). Early studies of HIV suggested that mortality correlated with loss of lean tissue rather than overall weight loss (Kotler et al, 1999). Hence, there is insufficient data at present to support an increase in protein intake for PLHIV above normal requirements for health i.e. 12 percent to 15 percent of total energy intake (WHO, 2003).

Fat
Fat oxidation increases in HIV-positive patients but carbohydrate oxidation is suppressed in AIDS (Arpadi, 2000; Sharpstone et al, 1999), suggesting that more fat than carbohydrate is used as fuel source. Recovery of weight loss usually occurs in patients with HIV/AIDS whose disease responds to ARV therapy, but a characteristic form of fat redistribution has been described (Hodgson et al, 2001; Grinspoon et al, 1997). It includes loss of fat from the cheeks producing a clinically striking gaunt facial appearance together with accumulation of fat around the neck (the buffalo hump), waist—the lipodystrophy syndrome. This fat redistribution is remarkably different from what occurs in weight loss as a result of poor dietary intake or metabolic disturbance. There is still disagreement on how to classify lipodystrophy, but the appearance of marked subcutaneous fat loss, development of buffalo humping of the fat between the shoulders, and the striking deposition of fat in the viscera are quite characteristic. Anthropometry, including waist-hip ratios, subcutaneous fat measurements and cross-sectional whole-body imagining are being used to define the morphological distribution of the fat more accurately (Knox et al, 2003; Forrester et al, 2002).

According to WHO (2003), there is no concrete evidence that total fat needs are increased beyond normal requirements as a consequence of HIV infection. However, special advice regarding fat intake might be required for individuals undergoing antiretroviral therapy or experiencing persistent diarrhoea.

Micronutrients
The role of micronutrients in immune function and infectious disease is well established.
However, the specific role of individual and multiple micronutrients in the prevention, care and treatment of HIV infection and related conditions has not been well established.

Observational studies indicate that low blood levels and decreased dietary intakes of some micronutrients are associated with faster HIV disease progression and mortality, and increased risk of HIV transmission. Some studies show that there is evidence that supplements of, for example, B-complex vitamins, and vitamins C and E, can improve immune status, prevent childhood diarrhoea and enhance pregnancy outcomes, including better maternal prenatal weight gain and a reduction of fetal death, preterm birth and low birth weight.

HIV-infected adults and children should consume diets that ensure micronutrient intakes at RDA levels. However, this may not be sufficient to correct nutritional deficiencies in HIV infected individuals. Results from several studies raise concerns that some micronutrient supplements, e.g. vitamin A, zinc and iron, can produce adverse outcomes in HIV-infected populations. Safe upper limits for daily micronutrient intakes for PLHIV still need to be established.

Table 2.8 shows the summary of the recommendations by WHO (2003) for macro and micronutrient intakes by PLHIV.

<table>
<thead>
<tr>
<th>NUTRIENT</th>
<th>RECOMMENDATIONS</th>
</tr>
</thead>
</table>
| ENERGY           | • Increase by 10% to maintain body weight and physical activity in asymptomatic HIV-infected adults, and growth in asymptomatic children.  
• During symptomatic HIV, and subsequently during AIDS, requirements increase by approximately 20% to 30% to maintain adult body weight. |
| PROTEIN          | Data are insufficient to support an increase in protein requirements due to HIV infection. |
| FAT              | There is no evidence that fat requirements are different because of HIV infection. |
| MICRONUTRIENTS   | • To ensure micronutrient intakes at RDA levels, HIV-infected adults and children are encouraged to consume healthy diets.  
• Nevertheless, dietary intake of micronutrients at RDA levels may not be sufficient to correct nutritional deficiencies in HIV-infected individuals.  
• There is evidence that some micronutrient supplements, e.g. vitamin A, zinc and iron can produce adverse outcomes in HIV-infected populations. |

(Source: WHO, 2003)
2.10.5 ART and Nutrition

There are a number of food interactions that influence not only the absorption and utilisation of ART but also impact on digestion, absorption and assimilation (Castleman et al, 2003). It is also known that certain antiretroviral therapies can produce a range of side effects and metabolic complications that have a significant impact on health and wellbeing. Some of the more common side effects include diarrhoea, loss of appetite, bloating, and nausea and unexplained weight change. Figure 2.9 shows the four main type of interactions that can occur between ARV and nutrition –

![Figure 2.9: Interactions between ARV and Food/Nutrition](Source: FANTA, 2004)

Food can enhance or inhibit the metabolism of ARV in the body. E.g. high fat foods inhibit the absorption on ARV in the body. Certain medications lead to fat changes in the body (lipodystrophy) also TB medications inhibit the metabolism of vitamin B6. Also ARV medications can alter the taste buds, make an individual anorexic thereby affecting the overall dietary intake. Taking medicines along with certain food or empty stomach can create problems like nausea, diarrhea, vomiting, etc (WHO, 2003; Pronsky et al, 2001). One of the important observations about the interaction between ART and nutritional status is that initiating ART often leads to a reversal of symptoms caused by HIV such as malnutrition and loss of body mass (including muscle mass). Increased appetite, improved food intake and reduced viral load improve nutritional status.

There is a growing amount of evidence about the long term complications of ART in a significant proportion of adults, children and infants living with HIV. These metabolic complications include disorders such as lipodystrophy, dyslipidaemia, insulin resistance, abnormalities in glucose tolerance, lactic acidosis, mitochondrial toxicity, and bone demineralisation. It appears
that these complications may be related to particular drugs. These side effects may have serious
consequence in terms of adherence with ART, increased risk of chronic diseases including
cardiovascular disease and diabetes, and reduced quality of life. These metabolic effects not
only impact on the health and wellbeing of PLHIV but may necessitate a shift to another ART
regime. Despite advances in the knowledge about interactions between ART and nutritional
status, many questions remain unanswered (Houtzager, 2009). Figure 2.10 summarizes the
nutritional management of common ARV side-effects –

<table>
<thead>
<tr>
<th>Side Effect</th>
<th>Recommended Nutritional Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anorexia</td>
<td>Eat small and frequent meals. Eat favorite foods. Select foods that are energy dense. Avoid strong smelling foods.</td>
</tr>
<tr>
<td>Change or Loss of</td>
<td>Use flavor enhancers such as salt, spices, or lemon. Chew food well and move around in mouth to stimulate receptors.</td>
</tr>
<tr>
<td>Taste</td>
<td></td>
</tr>
<tr>
<td>Constipation</td>
<td>Eat foods high in fiber content. Drink plenty of liquids. Avoid processed or refined foods. Exercise regularly according to capacity.</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>Drink plenty of fluids. Continue eating during and following illness. Prepare and drink rehydration solution regularly. Avoid fried foods.</td>
</tr>
<tr>
<td>Fever</td>
<td>Drink plenty of fluids. Eat energy and nutrient dense foods.</td>
</tr>
<tr>
<td>Flatulence</td>
<td>Avoid gas-forming foods, such as beans, cabbage, broccoli, and cauliflower.</td>
</tr>
<tr>
<td>High Blood</td>
<td>Eat a low fat diet and limit intake of foods rich in cholesterol and saturated fat. Eat fruits and vegetables daily. Exercise regularly according to capacity.</td>
</tr>
<tr>
<td>Cholesterol</td>
<td></td>
</tr>
<tr>
<td>High Triglycerides</td>
<td>Limit sweets and excessive carbohydrate and saturated fat intake. Eat fruits, vegetables, and whole grains daily. Avoid alcohol and smoking. Exercise regularly according to capacity.</td>
</tr>
<tr>
<td>Nausea or Vomiting</td>
<td>Eat small quantities of food at frequent intervals. Drink after meals and limit intake of fluids with meals. Avoid having an empty stomach. Avoid lying down immediately after eating. Eat lightly salty and dry foods to calm the stomach. Rest between meals.</td>
</tr>
</tbody>
</table>

Figure 2.10: Nutritional Management of Common ARV Side-Effects
(Source: FANTA, 2004)

In many parts of the world, supplementation using herbal and alternative therapies is a common practice for many PLHIV. Although the effects of these supplements are becoming clearer there is still much that needs to be learned about the interactions between ART medication and various traditional therapies (Castleman et al, 2003).

2.10.6 Nutrition Interventions
Alarmed by the rising trend of HIV/AIDS in several countries, and recognizing that nutrition should be integrated into a comprehensive response to HIV/AIDS pandemic, the World Health Assembly passed the resolution WHA 59.11 on Nutrition and HIV/AIDS in May 2006. The resolution urges the member states to make nutrition an integral part of their response to HIV/AIDS by identifying nutrition interventions for immediate integration into HIV/AIDS programming (World Health Assembly, 2006).
International organizations such as the World Health Organization (WHO), the Joint United Nations Programme on HIV/AIDS (UNAIDS), World Food Program (WFP), Food and Agriculture Organization (FAO) and The United States President’s Emergency Plan for AIDS Relief (PEPFAR) have recommended integration of food assistance into AIDS care and treatment programs (WFP, WHO and UNAIDS, 2008; PEPFAR, 2006). Several of these organizations have tailored interventions to specifically address malnutrition and food insecurity in areas with high prevalence of HIV, particularly in sub-Saharan Africa. In 2007, PEPFAR integrated food assistance interventions as an integral part of AIDS care and treatment services. Guidelines published jointly by FAO and WHO in 2003 offer simple dietary suggestions for people living with HIV and AIDS (WHO/FAO, 2002).

Marston and Cock (2004) reported that in countries with resource limited settings are unlikely to follow optimal food and nutrition recommendation(s) for ART due to lack of access to required foods and because of their already compromised nutritional status. Therefore, nutrition interventions become an important factor in maintaining the health and nutrition status of PLHIV. Health care providers and NGOs involved in HIV care and treatment are now increasingly utilizing targeted food assistance to improve nutritional and clinical outcome of their clientele. Various authors in their studies have identified the important role of nutrition interventions in improving the overall health and nutritional status of PLHIV (Duran et al, 2008; Suttajit 2007; Patricia et al, 2006; Sherlekar and Udipi 2002; Thuita and Mirie, 1999; Chlebowskii et al, 1995; Thommessen and Rundberget, 1993) and also on improving the adherence to the ART treatment (Cantrell et al, 2008; Nash, 2008).

**Food Supplements**

Food insecurity and undernutrition are increasingly recognized as factors that are important in the health and livelihoods of individuals living with HIV infection in poor settings (Ivers et al, 2009; Gillespie and Kadiyala, 2005). Food insecurity—meaning lack of access to food of sufficient quality and quantity to perform usual daily activities—contributes to a negative cycle of events that often worsens the effect of HIV infection on ability to work, attend school, contribute to family livelihoods and adhere to medications (Marston and De Cock, 2004; Haddad and Gillespie, 2001).

Data regarding macronutrient supplementation among adult PLHIV is limited and optimal composition of macronutrient supplementation for malnourished adults is still a matter of debate (Sztam et al, 2009). As a replacement or an addition to local staple foods, three candidate supplements are commonly referenced: high-energy Ready-to-Use Therapeutic Foods (RUTF) (Nutriset, 2006), corn-soya blends (USAID, 2006), and fortified blended foods (FBF) (WFP, 2000).
RUTF is a type of highly nutrient-dense spread (HNDS), a food product high in energy and micronutrients in which all powdered ingredients are suspended in fat and do not require any preparation or the addition of water before ingestion. RUTF, like other HNDS, can be stored for long periods, do not require refrigeration, and can be individually packaged and used effectively in areas where hygiene conditions are not optimal. Piwoz and Preble (2000) reported that RUTF improve weight gain mainly by increasing fat and not LBM so these do not prevent or reverse muscle waisting. However, contradictory studies show that it has been used successfully for community therapeutic care and nutritional rehabilitation in the pediatric population (Patel et al, 2005; Manary et al, 2004; Grillenberger, 2003) and recommended by WHO for the management of severely malnourished children (WHO et al, 2007).

Corn-soya blends, also referred to as High-Energy Protein Supplements, are blended flours which have been used effectively in the past in both emergency and protracted food relief operations (Mason, 2002). Corn-soya blends provide a higher calorie and protein content than many local carbohydrate-rich staple foods they are programmed to replace, but concerns have been raised regarding their suitability for the treatment of severe malnutrition given the low essential fatty acid and overall lipid content (Briend, 2001). Macronutrient supplementation (with or without nutritional counseling) on various clinical outcomes of people living with HIV led to weight gain and increase in CD4 count in developed countries (Koethe et al, 2009; Mahlungulu et al, 2007). Two studies from from Uganda (sub-Saharan African region) reported positive impact of food assistance on weight gain, and a minimal impact on delaying disease progression as measured by WHO staging (Rawat et al, 2010; Maina et al, 2004).

FBF are also blended flours designed to provide more comprehensive nutrition supplementation, and contain mixtures of cereals (typically corn or wheat), pulses, fats, vitamins and minerals. The WFP distributed almost 300,000 metric tons of FBF in 2006 (Hoppe et al, 2008). Economists have long proposed the possibility that, in addition to the direct health benefits for individuals and their households, increased caloric intake and improved nutritional status may lead to higher wages and labor productivity (Bell et al, 2003). In an experimental study in Zambia, food supplementation (corn-soy blend) was associated with better adherence to ART, after adjustment for sex, age, and baseline CD4 count, WHO stage, and hemoglobin (Cantrell et al, 2008). In a randomized controlled trial from Malawi (Ndekha et al, 2009) comparing supplementary feeding with a ready-to-use fortified spread compared to corn-soy blended flour with a similar energy composition, patients receiving fortified spread had a greater increase in BMI and fat-free body mass than those receiving corn-soy blend, but there were no significant observed differences in markers of disease progression, quality of life, or adherence to ART between the two groups.
According to Koethe et al, (2009), the design of future macronutrient supplementation trials must consider a range of variables, including the proportion of daily calories to supply, the choice of supplement, duration of supplementation, program exit criteria, logistics, and the uncertainties of human behavior.

In industrialized settings, various approaches have been used with adults such as supplemental formulas, including those with hydrolyzed/elemental protein and special protein formulas with whey, glutamine, arginine, or high-protein content (Sattler et al, 2008; Sutinen et al, 2007; de Luis et al, 2003; Charlin et al, 2002; Keithley et al, 2002; Micke et al, 2002; de Luis et al, 2001; Micke et al, 2001; Berneis et al, 2000; Clark et al, 2000; Schwenk et al, 1999; Zambelli et al, 1996) lipids, including fish oil or (n-3) fatty acid sources (Pichard et al, 1998; Mendez et al, 1998; Craig et al, 1997; Singer et al, 1997) and carbohydrate interventions (Schwenk et al, 1996). Gastrostomy tube formula feeding (Ockenga et al, 1996), parenteral nutrition (Melchior et al, 1998; Kotler et al, 1998; Singer et al, 1997), and appetite stimulants (Dejesus et al, 2007; Mwamburi et al, 2004) are also prescribed. Other methods to treat wasting and lipoatrophy have been examined, including anabolic steroids, growth hormone treatments (Gelato et al, 2007; Sattler et al, 1999), and cytokine inhibitors (Kaplan et al, 2000). In general, studies show that supplementation may increase energy intake but do not reliably result in increases in fat-free mass, body cell mass, or HIV-related outcomes like CD4 count and viral load (Mahlungulu et al, 2007). A study from South India reported that six-month supplementation with high energy and high protein resulted in significant increase in weight, BMI and MUAC though CD4 remained unchanged (Iliayas et al, 2006).

Some studies suggest a benefit in using micronutrient supplementation to slow HIV disease progression. A study in Tanzania found that women who received high dose multivitamin supplementation were less likely to have progression to advanced stages of HIV infection (Fawzi et al, 2004). These findings were supported by a study of HIV positive males and females with advanced symptoms in Thailand which showed decreased rates of death in adults who received high dose micronutrient supplementation (Jiamton et al, 2003). Daily micronutrient (antioxidants) supplementation improved body weight and body cell mass (Shabert et al, 1999); reduced HIV RNA levels (Muller et al, 2000); improved CD4 count (Muller et al, 2000) and reduced the incidence of opportunistic infections in small studies of adults with AIDS, including those on ART. Larger clinical trials demonstrated that daily micronutrient supplementation increased survival in adults with low CD4 count (Jaimton et al, 2003); prevented adverse birth outcomes when given during pregnancy (Fawzi et al, 1998) and reduced mother-to-child HIV transmission in nutritionally vulnerable women with more advanced HIV disease (Fawzi et al, 2002).
A longer 6-month study including supplements with arginine and omega-3 fatty acids failed to show significant benefit in terms of body composition compared with results observed in a group of control patients receiving dietary advice alone (Pichard et al, 1998). A comparison of formula supplemented with α-linolenic acid, arginine and RNA with a standard formula in a double-blind crossover study found greater weight gain with the supplemented formula (Suttmann et al, 2000). There are a number of studies reporting the importance of enteral feeds in improving the nutritional parameters of PLHIV (Kotler et al, 1991; Brantsma et al, 1991, Singer et al, 1992; Suttmann et al, 1993; Henderson et al, 1994; Chan et al, 1994 and Craig et al, 1994). Bounous et al, (1993), Micke et al, (2002) reported beneficial effects of whey protein concentrate in improving the weight and glutathione levels in HIV positive individuals.

Several studies have found that zinc supplementation reduces cases of diarrhoea among children in developing countries (Bhuta et al, 1999). One study in South Africa found that zinc supplements reduced bouts of diarrhea among HIV positive children, without hastening the progress of their HIV infection (Bobat et al, 2005). Studies undertaken on zinc supplementation on adults living with HIV paint an equally unclear picture. While some studies have found that zinc supplements do not have any impact on HIV positive patients (Carcamo et al, 2006; Villamor et al, 2006), another has shown a 60% reduced risk of diarrhea in the HIV positive participants of a study conducted over 18 months (Baum et al, 2010).

Daily beta-carotene supplements of 180 mg provided for 1 month resulted in a small but statistically significant increase in the total WBC count and percentage change in CD4 count in one trial (Coodley et al, 1993). Another trial, however, found no beneficial effect (Coodley et al, 1996).

In a randomized placebo-controlled study from Zambia, the effects of 2 weeks of oral daily supplements of multiple micronutrients (vitamins A, C, and E, selenium, and zinc) were examined among HIV-infected patients with persistent diarrhea (Kelly et al, 1999). In Thailand, daily multi-micronutrient supplementation for 100 days did not show any beneficial effect on CD4 count or viral load (Jiamton et al, 2003). Micronutrients did not reduce the duration of diarrhea or the mortality rate during the first month and had no effect on CD4 cell counts or hematological parameters. Kelly et al, (1999) reported no effect on diarrhoeal morbidity or mortality after vitamin A, C, E, zinc and selenium in HIV positive adults.

Despite the positive benefits reported with some micronutrient formulations, there is still insufficient evidence to recommend high dose supplements for all PLHIV and some studies have suggested harmful effects from vitamin and mineral supplementation. For example; maternal vitamin A and β-carotene supplements have been shown to significantly increase risk of mother-to child transmission of HIV in randomized trials and can increase mortality in
some children born to positive mothers (Drain et al, 2007). Also, the optimal formulation of a
daily multiple micronutrient supplement for HIV-positive individuals requires further studies
(WHO, 2003).

**Dietary Counseling**

Dietary intake may be influenced positively by nutritional counseling, by raising awareness
about needed quantities of food to meet increased demand and adequate dietary diversity, and
should be recommended in HIV care by the WHO (2008). In multiple studies, counseling has
been shown to increase intake and improve weight and fat mass and may also increase fat-free
mass and lean body mass (de Luis et al, 2003; de Luis et al, 2001; Schwenk et al, 1999). The
goal of nutritional counseling is to improve the quality of the diet to reach required amounts
of energy, protein, and micronutrients as well as to increase intake to meet changes in REE.
Indeed, counseling can increase intake itself (de Luis et al, 2003; Zambelli et al, 1996) and can
be employed with relatively few resources to accomplish dietary diversity, which is associated
with improved micronutrient intake and improved child growth (Moursi et al, 2008; Kennedy
et al, 2007; Steyn et al, 2006; Penny et al, 2005). Counseling remains the first-line therapy in
most programs for mild and moderate malnutrition (Sztam et al, 2009).

Focus on nutritional counselling and development of Nutrition Management Programme is a
must to delay progression of HIV to AIDS, reduce OI’s, to keep the immune system strong and
improve the quality of life in PLHIV in resource limited setting in absence of ARV. Adequate
nutrition and food is recognized along with nutrition interventions and psychological support to
break the silence in the fight against HIV AIDS (Suttajit M, 2007; Sherlekar and Udipi, 2002;
Dey et al, 2000; Thuita and Mirie, 1999). A study by Segal-Isaacson (2006) reported that health
education sessions by a therapist improved the dietary patterns of disadvantaged HIV infected
women in America. An RCT compared nutritional counseling alone with supplements given
for 6 weeks. There was increased energy intake but no discernible effect on body composition
or quality of life.

A training manual developed in Ethiopia asserts that food-based approaches to increasing
vitamin and mineral intake and optimizing immune function are “the most preferred strategy”
and that foods should include local vegetables and fortified staple products (Collins et al, 2006;
MoARD/FAO, 2005). However, there is no international consensus on a universal HIV food
ration, making it difficult to determine programmatically what any food basket should contain
(Sanchez et al, 2007; Collins et al.). Furthermore, food rations require resources, but few
data exist on the cost-effectiveness of nutritional interventions in the context of HIV care in
developing countries (Mamlín et al, 2009; Blinkoff et al, 2005; Fakande and Malomo, 1998;).
Studies by McKinley et al (1994), Schwenk et al (1994), Burger et al (1993), Chlebowski et al (1992), Wandall et al (1992), Dowling et al (1990), and mostly conducted in Sub-Saharan African region reported beneficial effects of nutritional supplementation along with dietary advice. These studies reported increase in dietary intakes, progress in weight gain and thus improvement in anthropometric measurements like BMI, weight and MUAC. Contradictory results have been reported by Bowie et al, (2005) which reports that food supplementation to chronically ill PLHIV restricted to home did not resulted in healthy outcomes.

HIV affects immune system of the body which inturn affects the nutritional status of an individual. The interaction between HIV and Nutrition is complex and related to each other. Nutrition interventions in the form of food or micronutrients along with dietary advice are identified as potential mediums to combat the malnutrition in PLHIV. Therefore, early identification of malnutrition in PLHIV and devising of appropriate strategies is necessary for good health and quality of life of these individuals.