Acquired Immuno Deficiency Syndrome (AIDS) has become the most dreadful disease humankind has ever faced (UNAIDS, 2001) affecting more than 33.4 million people worldwide. It poses a major public health threat in India as well, and has the potential to undermine the significant progress that has been made in poverty alleviation, agriculture and rural development over the last 50 years (NACO/WFP, 2004).

AIDS has been defined as a disease caused by a retrovirus known as the Human Immunodeficiency Virus (HIV), which attacks and impairs the body’s natural defense system against disease and infection (UNAIDS/WHO, 2009). Sometimes called “Slim disease” AIDS is an advanced stage of HIV infection when the person starts having opportunistic infections, or when the CD4 count is below 200 cells/mm in the presence of HIV infection. It is a disease that affects humans leading to a weakened immune system through HIV. This virus enters the body primarily through three major routes ie. unprotected sexual intercourse with a person already carrying the virus, transfusions of contaminated blood and its by-products, the use of un-sterilized instruments, and from an infected mother to her child before or during birth, or through breastfeeding (Fenton and Silverman, 2004; USAID, 2001).

To date, the HIV/AIDS epidemic has not been overcome anywhere in the world, making this disease a serious health challenge for the new millennium. Even more disturbing, is the fact that the vast majority of infected people are unaware of the fact that they have acquired HIV (UNAIDS, 2001). India is on the brink of a generalized epidemic as even a small increase in prevalence would lead to an exponential increase in the number of people living with HIV due to the large population base.

In response to this growing epidemic, the Government of India formulated the National AIDS Committee in 1986 and launched the National AIDS Control Programme (NACP) in 1987. The National AIDS Control Organization (NACO), a semi-autonomous body within the Ministry of Health and Family Welfare, was established in 1993 to implement NACP-I, which included: strengthening management capacity for HIV control, improving surveillance, promoting public awareness, improving blood safety and controlling STDs. NACP-II was launched in 1999 which included: shifting the focus from awareness raising to behavioural change; conducting evidence-based annual reviews; implementing management reforms; and decentralizing service delivery to states. Presently, NACP-III (2007-2012) is operational, of which major goals and objectives are:

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

There are various factors and co-factors that place individuals and groups at risk of developing HIV/AIDS; these include economic factors such as poverty, lack of knowledge and education, cultural, political and demographic factors (Butler, 2000); dangers in human behaviour (Gordon, 2000), including commercial sex work (Ulin, 1992); gender (Piwoz and Preble, 2000) race (Fenton and Silverman, 2004) and the poor availability and un-affordability of medication and medical advice (Butler, 2000).

1.1 THE IMPACT OF HIV/AIDS

The disease is no longer restricted to cities or high risk groups but is rapidly spreading into the rural areas and other unreached areas affecting a large population especially the people in their productive years (15-45 years). The burden of HIV/AIDS has significant impact on many aspects of life of the infected. The infection/death of a productive family members destroys many lives and families and the strain is felt on the workforce and health services. These factors ultimately have negative effects on the development of the nation as a whole. The impact of disease on different dimensions of life of the infected person can be listed as –

1.1.1 Impact on immune system: HIV has a devastating impact on immune function, making infections more virulent (Semba and Tang, 1999). Although, the introduction of ART has significantly improved the lifespan of HIV infected individuals but increased lifespan had made them susceptible to other life threatening diseases along with increased exposure to stigma and discrimination by the society (Currier et al, 2008; Oh and Hegele, 2007; Morse and Kovacs, 2006; Palella et al, 1998).

1.1.2 Impact on work capacity: Globally, HIV/AIDS accounts for 84.5 million Disability Adjusted Life Years (DALYs). In SEAR countries, up to 10.6 million DALYs are lost due to HIV/AIDS. It is the sixth leading cause of DALYs in SEAR countries (WHO, 2007). Studies from African region have demonstrated that HIV/AIDS has profoundly impacted the subsistence agriculture (Drimie, 2003; FASAZ/FA, 2003; NAADS, 2003), commercial agriculture (Guinness et al, 2003; Morris et al, 2000) and has also negatively affected non-agricultural livelihoods (Ellis, 1998; Reardon et al, 1992).

1.1.3 Financial Impact: Households with HIV/AIDS deaths had reported reduced savings, reduced expenditures on consumer durables, and have sold assets in order to raise or supplement income (Singh, 2005). The potential loss of income resulting from illness and death does not
only place a heavy burden on rural households, but also reduces the availability of labour for farm and domestic work (Piwoz and Preble, 2000). Long mourning periods following the death of a family member also have a negative impact on labour availability. The estimated annual cost of HIV/AIDS appears to be about one percent of the GDP of India (Anand et al, 1999). Also, the average burden of the cost of treatment for a low-income family in India was 49 percent of the total household income (Duraisamy et al, 2006).

1.1.4 Social Impact: The potential of HIV/AIDS to disrupt society is far-reaching and multifaceted (NICDAM, 2000). Food insecurity may be experienced in households with HIV infected individuals. When adults become too incapacitated to work and provide food for themselves and the family (Piwoz and Preble, 2000), it results in a decrease in income and fewer resources such as labour and money to obtain food. The stigma associated with HIV/AIDS and the prejudice experienced by AIDS sufferers at work, in the community and at home, result in a lack of the support mechanisms that are available for people with other fatal diseases (NICDAM, 2000). In India, individuals infected with the virus experienced discrimination and a few of them have had to send their children away to distant relatives, and withdraw children from school according to Singh (2005).

1.1.5 Impact on Women: Pradhan and Sundar (2006) have reported that the rates of hospitalization and illness is low among women and knowledge and awareness about HIV/AIDS is lacking. Females face more stringent stigma and discrimination from society due to their positive status, widows face double burden of stigma and discrimination from family and society and HIV positive women do not have much say in matters related to sex and use of contraceptions. Thus, the situation of HIV positive women is compounded by the dominance of strong patriarchal society, economic dependence on men and high illiteracy rates makes them more vulnerable to acquire HIV infection (Doshi and Gandhi, 2008).

1.1.6 Impact on education: The AIDS epidemic has a profound impact on the educational systems of many countries. Many teachers and students die or leave school as a result of HIV/AIDS, leading to a decrease in the quality and efficacy of these systems (Hattingh, 2005). Many studies reported the negative impact of HIV/AIDS on children’s schooling (Deininger et al, 2003; Gilborn et al, 2001; Urassa et al, 1997). Discrimination against children in schools and in the community has been reported in India (Singh, 2005).

1.1.7 Impact on overall Quality of Life: 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 the physical health aspect, but also from the mental and social health point of view and cause numerous problems in useful activities and interests of the patients (Aranda- Naranjo, 2004). Comorbid psychiatry illness including depression are common in HIV infected individuals (Kelly et al, 1998).
1.1.8 Impact of Nutritional status: 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. 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.

1.2 NUTRITION AND HIV

HIV-induced immune impairment and heightened subsequent risk of infection can worsen nutritional status. HIV infection may result in poor nutritional status through the following conditions: depressed appetite, poor nutrient intake and limited food availability; chronic infection, malabsorption, metabolic disturbances and muscle and tissue catabolism; fever, nausea, vomiting and diarrhoea; depression; and the side-effects of drugs used to treat HIV-related infections. Some of the common complications encountered in HIV-infected people are: weight loss, wasting, derangement in biochemical parameters, opportunistic infections like TB, oral candidiasis, bacterial infection, ulcerations, fungal infections to name a few (Kumarasamy et al, 2005;2003).

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. Antiretroviral therapy is given to PLHIV as part of their medical treatment. As ART interventions scale up in resource limited settings, addressing food and nutrition implications becomes a critical component of care and support programs and services. The treatment of human immunodeficiency virus (HIV) infection with HAART (highly active antiretroviral therapy), particularly the inclusion of protease inhibitors, was a major advance in improving the survival of HIV-positive individuals. However, this therapy is associated with a lipodystrophy syndrome, which involves the wasting of adipose tissue from peripheral sites with the preservation of central adipose depots, hyperlipidemia, impaired glucose tolerance and overt type 2 diabetes (Carr et al, 1999). Interactions between ARVs and food and nutrition can significantly influence the success of ART by affecting drug efficacy, adherence to drug regimens, and the nutritional status of PLWHA. Managing the interactions between ART and food and nutrition is a critical factor in the extent to which the therapy is effective in slowing the progression of HIV/AIDS and improving the quality of life of PLWHA. ARV interactions with food and nutrition can be explained in four ways:
• Food can affect medication absorption, metabolism, distribution, excretion. For example, a high energy, high fat, high protein meal decreases absorption of protease inhibitor (PI) indinavir (Prongsky et al, 2001).

• Medications can affect nutrient absorption, metabolism, distribution, excretion. For example, certain PIs can cause changes in the metabolism of lipids resulting in an elevation in blood cholesterol and triglyceride levels (Gelato, 2003).

• Medication side-effects can negatively affect food consumption and nutrient absorption: the side-effects of some medications can lead to reduced food intake or reduced nutrient absorption that exacerbates the weight loss and nutritional problems experienced by PLHIV. For example, some studies have shown that certain ARVs increase the risk of osteopenia and osteoporosis, though further research is continuing on the subject (Mondy and Tebas, 2003).

• Combination of medications and certain foods can produce unhealthy and dangerous side-effects. For example, consuming drinks that contain alcohol while taking didanosine can cause pancreatitis, an inflammation of the pancreas that can be serious and even fatal (Prongsky et al, 2001).

### 1.2.1 Nutrition Interventions

Various strategies have been adopted to improve the health and nutrition status of PLHIV. Each strategy has shown its merits and de-merits. Although giving high doses of multi-micronutrients is not advised, still a diet rich in vitamins and minerals is emphasized in order to delay the progression of HIV to AIDS (WHO, 2003).

#### Supplementation

Various supplementation strategies have been tried for improving the quality and quantity of diets consumed by PLHIV.

- **Food Supplementation**
  
  Macronutrient supplementation (with or without nutritional counselling) of PLHIV led to weight gain and increase in CD4 count in developed countries (Koethe et al, 2009; Mahlungulu et al, 2007). 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 has been used successfully for community therapeutic care and nutritional rehabilitation in the pediatric population in African region (Grillenberger, 2003). Corn-soy blend comprising of maize, vegetable oil, peas and soy was associated with better adherence to ART, after adjustment for sex, age, and baseline CD4 count, WHO stage, and hemoglobin however, the immediate effects of body weight and immune reconstitution were minimal (Cantrell et al, 2008). Fortified blended foods are precooked and are often distributed as flour and require minimal cooking. A study of FBS (wheat-soy blend) in India revealed that the intervention
did not significantly increased the body weight of PLHIV adults (Swaminathan et al, 2010).

- **Multiple Micronutrient Supplementation**
  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). 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. Despite the positive benefits reported with some micronutrient formulations, there is still insufficient evidence to recommend high dose supplements for all PLHIV.

- **Therapeutic Formulae**
  There are 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; Craig et al, 1994). Bounous et al, (1993) and Micke et al, (2002) reported beneficial effects of whey protein concentrate in improving the weight and glutathione levels in HIV positive individuals. 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).

**Counseling**

According to WHO (2008) 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. Counseling remains the first-line therapy in most programs for mild and moderate malnutrition (Sztam et al, 2009). There are various counselling aids like flipbooks, nutrition and dietary guidelines booklets and counseling charts that have been developed worldwide which aim to bring about behavioural change in PLHIV. These aids have been adapted in the native language of the people for better understanding, adherence and compliance. Counseling not only increases the dietary intake (Zambelli et al, 1996; de Luis et al, 2003) but can also be employed with relatively few resources to accomplish dietary diversity, which is associated with improved micronutrient intake and improved child growth (Penny et al, 2005; Steyn et al, 2006; Kennedy et al, 2007; Moursi et al, 2008). African Network of People with HIV/AIDS have developed booklets which include food preparation instruction (to minimize contamination) and recipes utilizing local foods for people suffering from different digestive problems and symptoms such as diarrhoea, candidiasis and nausea (Piwoz and Preble, 2000). Similarly, FANTA has developed a flipchart for use in home-based settings in Zambia in 2006.
1.3 SIGNIFICANCE OF THE STUDY

The proposed study addressed the issue of the importance of nutrition during HIV/AIDS infection. It is now well-established that good nutrition plays an important role in delaying the progression of HIV to full-blown AIDS as well as to maintain good health and quality of life. Various studies have been carried out across the globe to establish this fact; however, even after two decades of this epidemic in India, not much work has been done in the area of nutrition and HIV/AIDS.

Labour resources get affected when a member of a family falls prey to HIV, especially if he or she is an income earner. With the progression of HIV/AIDS, cash resources become increasingly constrained as incomes decline and medical costs rise. As cash resources and assets deplete in order to meet the rising costs of treatment, the non-essential and then productive assets are sold. This may have a profound effect on the psychological health of HIV positive individual which needs to be explored and studied. The stigma attached to this disease, especially in a country like ours, leads to social as well as mental torment to the infected people. After knowing about the HIV-positive status, the person becomes pessimistic about life, which affects not only his/her health status but also the mental and social dimensions of health. This study enquired about the quality of life the PLHIV. This would also give an insight into what other problems these infected individuals face apart from health and nutrition.

It is well-documented that HIV infection impairs the body’s immunity to fight infections and then the vicious cycle of malnutrition comes into play. From the onset of the disease, HIV infection places a strain on the body leading to malnutrition and wasting. The HIV-infected people are often found to be malnourished and deficient in various nutrients. The proposed work hence, investigated the effect of HIV infection on the anthropometric, biochemical and nutritional profile of an infected individual,

Various nutrition interventions including counseling on specific behaviours, prescribed/targeted nutrition supplements and linkages with food-based interventions and programmes have been employed across the globe to improve the health and nutrition status of PLHIV (Piwoz, 2004). Various strategies like provision of corn-soy blend, RUTF and blended foods to PLHIV have shown an improvement in ART attendance rates, BMI and WHO Clinical stage of PLHIV (Ndekh et al, 2009; Cantrell et al, 2008).

Unfortunately, in India, not many nutrition supplementation programmes are currently in operation for PLHIV’s and nutrition does not form the core of any programme meant for PLHIV. Children Investment Fund Foundation (CIFF) along with Tamil Nadu State AIDS Control Society (TANSAC) provided comprehensive care and treatment to PLHIV including nutrition
services like nutrition counselling. In Andhra Pradesh, CIFF with support from Global Fund to Fight AIDS, TB and Malaria (GFATM) provided HIV positive adults and children with medical care, psychosocial support and nutrition education. YR Gaitonde Centre for AIDS Research and Education (YRG CARE) along with TANSAC provided nutritional counseling, assessment and individual diet plans to PLHIV. Another nutrition oriented programme was operational in Tamil Nadu by NACO which was assisted by World Food Programme (WFP). Under this programme, TANSAC was providing nutrition supplement and nutrition counselling to people infected with HIV. The supplement was made up of wheat and soya and was suitably fortified with various micronutrients. It provided 368kcal and 18g protein per 100g of supplement. The same nutrition supplementation programme was also operational in the state of Orissa. Evaluation of this programme (in Orissa) in terms of its impact on improving the nutritional status of the beneficiaries was also studied. The impact of nutrition supplementation in terms of improvement in anthropometric and biochemical profile, reducing the signs and symptoms, and decreasing the occurrence of opportunistic infections was also studied.

The study thus, addressed the issue of nutrition and HIV as a whole, throwing light on the physical, mental and social health, dietary adequacy and nutritional programme contribution in improving the nutritional status of PLHIV.

### 1.4 OBJECTIVES

The main objective of the study was to assess the nutritional status and QOL of PLHIV and to evaluate the impact of a nutrition intervention on the same. The specific objectives of the study are enumerated below:

1. To assess the socio-demographic, health and nutrition profile of HIV-infected adults.
2. To assess the quality of life of PLHIV.
3. To assess the impact of the nutrition intervention on:
   a. Nutrition and health status of PLHIV.
   b. Knowledge, attitude and practices of PLHIV.
   c. Quality of life of PLHIV.