CHAPTER 5
SUMMARY AND CONCLUSIONS
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The synergistic relationship between nutrition and immune system has been well established. Optimal nutrition, involving protein, energy, minerals and essential micronutrients, serves to strengthen and protect the immune system as well as the many generalized aspects of host defense. At all times during HIV infections, proper nutrition and aggressive nutritional support play essential role. Thus, the present study was conducted with an objective to assess the nutritional status and quality of life of people living with HIV/AIDS and to study the impact of nutrition intervention on the same.

Health and Nutrition Profile of PLHIV in Delhi

The objective of Phase 1 of the study was to assess the socio-demographic and health profile; nutritional status and quality of life of PLHIV in Delhi.

The phase 1 was carried out at the ART centre of Guru Teg Bahadur Hospital, Shahadara, Delhi. A total of 400 subjects (245 males, 144 females and 11 transgender) were included in the study. Of the total 400 subjects, 262 (65.5%) were on ART while 138 (34.5%) were not on ART but registered with the ART centre.

The data on socio-demographic profile, dietary profile and knowledge, attitude and practices was collected using a questionnaire. All the anthropometric measurements (height, weight, waist and hip circumference, MUAC and calf circumference) were taken using standard procedures, body fat and skeletal muscle percentage, visceral fat and RMR was taken using bioelectric impedance analysis. Quality of life was studied using WHOQOL-HIV Bref scale and nutritional assessment was conducted using Nestle’s Mini Nutritional Assessment Scale. One day 24-hour dietary recall was done for nutrient intake calculations.

Majority of the sample belonged to the younger age group of 21 – 40 years (82.8%) indicating that the infection is affecting the most productive age group of the society. More than 70 percent of the sample was married with a single partner and heterosexual route was found to be the major route for transmission of the infection. Interview sessions revealed that women were majorly infected by their spouse. Men reported that having multiple sexual partners and indulging in unsafe sexual practices led to their HIV positive status.

The level of illiteracy was higher among females (43.1%) than males (21%) and majority of the transgender were illiterate (80.8%). More than 80 percent of the participants followed Hinduism as their religious path. Family profile indicated that nuclear family system predominated (63%) with average family size of four. The sample had a diverse occupational profile 29 percent being
self-employed or businessmen. These included small time businesses like traders, shopkeepers, suppliers, etc. Only 10 percent of sample were heavy workers, mainly construction workers and 20 percent were salaried people at a lower level in the hierarchy of an organization. The rate of unemployment increased by 12.6 percent from the time of detection of the virus to the time of interview due to ill health and HIV positive status per se. More than half of the sample reported their annual family income to be less than Rs. 30,000. Hence, the sample belonged to the lower income strata and visited the ART centre where medicines are given free of cost.

The health status was studied using WHO clinical staging criteria, number of symptoms/opportunistic infections, CD4 count and haemoglobin level. The biochemical parameters were noted from the white NACO card which is maintained by the ART centre and is kept confidential. For every registered patient this card which contains their demographic information, biochemical test reports, medications and list of symptoms/OI’s is filled at every visit to the centre. More than 80 percent of the sample belonged to the symptomatic stages i.e. 2 and 3 of WHO clinical stage. The common symptoms/OI’s experienced included weakness, anorexia and weight loss. Also, subjects suffered from multiple symptoms at one time indicating depressed immunity and poor health status. The mean CD4 count of the sample was below 500 cells/cumm (291.68 ± 183.8cells/cumm) indicating the damage to the immune system and need for ARV treatment and other non-pharmacological interventions (counselling, dietary interventions, etc) in the present group. Classification according to CD4 count indicated that 30 percent of the sample had irreversible condition known as AIDS (indicated by CD4 count <200 cells/cumm); 60 percent had damaged immune system as indicated by CD4 count between 200 – 500 cells/cumm and only around 10 percent of the sample had CD4 count above 500 cells/cumm. Also, those on ART had significantly higher CD4 counts as compared to those not on ART, thus reflecting the beneficial effect of ART on CD4 count. Anaemia was highly prevalent in the present sample (74% in males; 85% in females and 82% in TG) with mean haemoglobin levels in males (11.8 ± 1.7g/dl), females (10.3 ± 1.6g/dl) and transgender (11.4 ± 1.5g/dl) group being lower than normal values. Recurrent OI’s, low dietary intake and other metabolic abnormalities may explains the high prevalence of anemia in the present population.

Anthropometric profile indicated that 40 percent of the sample was malnourished as indicated by BMI <18.5kg/m2. Around 46 percent of PLHIV in the present sample belonged to the normal category of BMI (18.5 – 22.9kg/m2) which may be attributed to the fact that they were ambulatory and visited to the ART Centre for their treatment. No significant gender differences were found in BMI (p>0.05). The mean waist circumference (WC) of the sample was 73.6 ± 9.8cm, with males (75.2 ± 9.5cm) and TG’s (79.4 ± 11.5cm) was significantly higher than that of females (70.3 ± 9.5cm)(p<0.05). This mean was much less than the recommended WC indicating already compromised nutritional status of the present population. The mean MUAC of the study sample was 23.2 ± 3.06 cm and only 20 percent was below the cut-off of 21cm. In
the present sample they were either not on ART or they were consuming ARV medications for
less than 6 months, hence redistribution of body fat may not have occurred. The mean waist-
to-hip ratio (WHR) of the sample was 0.87 ± 0.07 cm, the WHR of males (0.89 ± 0.08 cm) and
TG (0.92 ± 0.09 cm) being significantly higher than that of females (0.84 ± 0.06 cm) (p<0.05).
Classification of subjects according to the normal body fat % cut-offs indicates that nearly 50
percent of women, 30 percent of males and 18 percent of transgender had body fat percentages
below normal. In females, this is worrisome as smaller waist and hip circumferences along with
low body fat percentage indicates complete loss of fat stores in these women. RMR of males
and TG was significantly higher than that of females which may be attributed to the fact of
males having high fat-free mass as compared to females. The mean skeletal muscle percentage
for the sample was 32.1 ± 8.9 percent (12.5 – 46.4%) which was much less than the normal
of 42 percent in males and 36 percent in females. Low muscle percentage indicates decline of
muscle mass in the present sample which may be due to the HIV infection itself as studies have
shown a faster decline in muscles in HIV positive individuals. Occurrence of opportunistic
infections and decrease in CD4 count is an indication of deteriorating health due to HIV virus.
The present study revealed that those with more number of infections/symptoms and low CD4
count had poor anthropometric profile as compared to those with less number of infections/
symptoms and higher CD4 count. This indicates a probable correlation between OI’s and CD4
count and anthropometry wherein one affecting the other.

There is no specific scale developed for PLHIV which can be easily applied in field settings
including hospitals to assess the degree of malnutrition in them. Therefore, the Mini Nutritional
Assessment Scale (MNA) which takes into account the dietary intake, anthropometric
measurements, ambulatory status, medication history and symptom history was adopted. The
results show that more than 50 percent of the sample (51.5%) was at-risk of malnutrition, around
35 percent was malnourished and only 15 percent were in normal range. The results were quite
similar to those we got from BMI which also indicated that around 40 percent of the sample
was malnourished. Also, those in normal category of MNA scale had higher CD4 count than
those in at-risk or malnourished category and as the subjects moved up i.e. from malnourished
category to at-risk to normal their CD4 count and haemoglobin increased. Hence, improvement
in nutritional status, CD4 count and haemoglobin are closely interrelated.

The study also assessed the nutrition related knowledge, attitude and practices among PLHIV
using pre-set questionnaires. The overall scores for all knowledge (8.3 ± 2.2), attitude (34.4
± 3.7), practices (8.1 ± 2.3) and KAP total (50.8 ± 5.5) lied in the medium category (6-10 for
knowledge and practices; 26-35 for attitude and 36-55 for KAP total) for the entire sample.
This may be explained partially by the fact that the sample was registered at ART centre and
was exposed to the counseling by counselor which included information about HIV and its
transmission, risk factors, healthy practices and dietary importance. Also, mean scores for
knowledge, attitude and total KAP increased significantly (p<0.01) as the level of education increased. However, the scores for practices did not increased significantly with the level of education (p>0.05). This gives an indication that though PLHIV possess knowledge and have positive attitude for HIV but did not translate this knowledge into practice.

Quality of life of PLHIV is an important parameter to be studied as the disease in our country is attached with stigma and sufferers have to struggle not only physically but also in their day-to-day life activities. This fact also came out in the present study as respondents reported that they had to leave their jobs due to their positive status and also from their family/friends. They fear the detachment that would follow once society knows about their positive status. The quality of life was studied using WHOQOL-HIV-Bref scale containing 31 questions which is a brief version of WHOQOL-HIV scale with 100 questions. The sample scored maximum in the domain of spirituality, religion and personal beliefs (14.5 ± 2.9) and minimum in the level of independence (11.9 ± 3.3). This can be explained by the fact that no matter how compromised their health status is, their belief in the supreme power was undaunted. The females scored significantly lower than the males on the domains of physical, psychological, level of independence and g-facet. Low levels of literacy among females, unemployment, financial dependency and social boudations can be the contributory factors for lower scores on QoL domains by females. Female subjects also reported that they acquired infection from their spouse which brings in more frustration towards partner, themselves, disease and the society. Further analysis revealed that those who were either divorcee or widowed scored poorest on all the domains of QoL as compared to those who were married. Also, it can be seen that the families with annual income less than Rs. 20,000 had significantly lower scores on five domains (psychological, level of independence, social relationships, environment and g-facet) of QoL out of a total of seven. This indicates that monetary security played a significant role in overall quality of life of an individual. Positive correlation between different domains indicated that damage to any one domain affected the overall quality of life of PLHIV. Also positive correlations between QoL domains and physical and clinical health indicates close associations between them and the improvement in one aspect improves the other.

Dietary profile indicated more non-vegetarian subjects with chicken as the preferred choice. Vitamin or mineral supplement consumption was also negligible in the present study. Three meal pattern i.e. breakfast, lunch and dinner was common in the present sample and it usually comprised of cereal-pulse combination. Among cereals, wheat and rice was mainly consumed wherein former was preferred over the latter. Wheat was mainly consumed in chapatti form without any ghee/oil and rice in boiled form. The analysis about kind of indulgences revealed that 71.4 percent of the respondents consumed either cigarette, bidi, alcohol, pan masala or tobacco.
The intake of all the food groups was lower than the suggested intakes by ICMR (2010). The results indicated the need for improvement in the dietary habits of the present sample.

The subjects were not able to meet the RDA for all the nutrients including energy. Majority of the subjects could not even meet 2/3rd of the RDA for protein (40%), calcium (50%), iron (53%), thiamine (25%), riboflavin (66%), niacin (46%), folic acid (97%), vitamin B12 (76%), as indicated by NAR values of less than 0.66. The intake for fat and vitamin C was more than the daily recommended allowance. The low intake of nutrients may be attributed to the fact that the food intake was qualitatively and quantitatively insufficient. Which can be explained to financial constraints, prevalence of multiple HIV symptoms/OI’s which reduces food intake and digestion, ignorance to healthy food and unhealthy dietary practices like drinking tea with food, high cigarette/bidi/pan masala intake, etc.

Thus, it can be concluded that in the present sample, HIV affected the young the most and heterosexual route was the major cause of HIV transmission. The health was compromised as indicated by poor CD4 count and low haemoglobin levels. The present sample had a fragile nutritional status as indicated by lower than normal anthropometric measurements. Further, 34 percent of the subjects were malnourished over 50 percent of the sample were “At-risk” of malnutrition according to MNA scale. The mean scores on nutritional knowledge, attitude and practices were in the moderate category. The quality of life of the present sample was also moderate wherein females scored significantly lower than males on majority of QoL domains. Also, QoL was found to be affected by the demographic profile, nutritional status anthropometry and biochemical parameters. The dietary profile was also poor as the intake of all the food groups were below the suggested intakes by ICMR (2010) for healthy Indian population. Also, the nutrient intakes were below the ICMR (2010) recommendations for all the macro and micro nutrients showing poor nutritional profile of the PLHIV. Thus, the health and nutrition profile of PLHIV in Delhi was compromised which demanded attention in terms of nutrition interventions.

EFFECT OF NUTRITION INTERVENTION ON HEALTH AND NUTRITION PROFILE OF PLHIV

Phase 2 aimed to study the impact of nutrition supplementation on the health, nutrition profile and quality of life of PLHIV. It was conducted in Behrumpur and Sambalpur districts of Orissa.

The experimental group was enrolled from MKCG Medical College, Berhampur while control group was taken from VSS Medical College, Sambalpur. At baseline, 153 PLHIV were enrolled in experimental and 33 in control group. Endline assessment for experimental was done at eight months on 96 subjects while for control group it was done at 11 months on 20 subjects.
The tools and techniques employed in Phase 1 were used for collecting data in phase 2 as well. The food supplement (NutriPlus) provided to the beneficiaries was a wheat-soy blend (75:25) in pre-cooked powder form. The supplement was packed in one kg packet and was given to the PLHIV on ART regimen via take-home ration strategy of 3kg per month. It was accompanied by a measuring spoon of 25g. The supplement provided 368kcal and 18g of protein per 100gm. A checklist was administered to the experimental group subjects to elicit information on the acceptability and to track the compliance to the supplement. The checklist was administered by the researcher at the baseline, midline and endline. For the remaining months, it was checked by the counselor at the time of counseling the patient.

Sambalpur (Control Group) was a semi-urban population while Behrampur (Experimental Group) was more rural in nature. The dwellings of the experimental group was “kutcha” and the main occupation was small time farming or heavy workers, labourers, etc; while the Control group stayed in “kutcha-cum-pucca” houses, worked as drivers or were self-employed in small time businesses.

The distribution of sample according to age indicates that maximum percentage of PLHIV belong to the age group of 31 – 40 years in both experimental (55.6%) and control (45.4%) group. In both the groups, sexual route (multiple sexual partners and unsafe sexual practices) was the main route of HIV transmission (97% in control group and 98% in the experimental group) and females reported that they acquired the infection from their husbands. Data on the marital status revealed that 69 percent of the sample was married (85% in control group and 66% in experimental group). Only 6 percent of control group sample was illiterate while 31 percent of experimental group was illiterate. There were more percentage of PLHIV in the heavy work category (43%) in the experimental group than the control group (6.1%). In the control group most of the PLHIV were involved in some kind of business (39.4%) like operating taxi services. The income profile shows that majority of the experimental (46%) and control group (36%) subjects had an annual family income of less than Rs.20,000.

The common indulgences found in the present study population was tobacco (45.4% in control and 33% in experimental); alcohol (39.4% and 5.9%); bidi (24.2% and 9.2%) and cigarette (12.1% and 5.2%).

Majority (85% in control group and 88% in experimental group) of the subjects in both experimental and control group were non-vegetarian. Among non-vegetarians, fish (85.6%) was the most preferred item in the experimental group while control group subjects consumed chicken, fish and meat equally. In both the groups, three-meal pattern (breakfast, lunch and dinner) was common.
Refined oil (62%) and mustard oil (46%) were found to be the preferred medium to cook food. Majority of the subjects in both experimental (78%) and control group (88%) consumed cow milk (purchased from the local vendor) and only 10 percent of the subjects in both the groups consumed toned packeted milk. The common beverages consumed were tea, coffee, milk, juice and cold drinks. Tap water was the preferred medium for drinking water (79% in control group and 40% in experimental group).

It was found that 57.3 percent of the subjects faced some kind of health problem on consuming the supplement. The common problems that were reported included bad taste (49%), followed by gastric disturbances like diarrhoea (18%) and vomiting (12.5%). Most of the subjects consumed it in the form of halwa (54%) by cooking it with water and sugar; upma (31%), chakli (24%), with milk and sugar (18%), with only water (12.5%) and chatua (2%) were some other forms of consumption.

The categorical and continuous baseline characteristics between the experimental and control groups were compared using Chi-square/Fishher’s exact test and student’s t-test. The outcome parameters were compared between the groups at the end of the study using ANCOVA adjusting for the respective baseline outcome variable.

**Effect on WHO Clinical Profile:** In the experimental group, a significant shift (p<0.01) was seen in the clinical staging of PLHIV. Before supplementation, only 5.2 percent of subjects were in stage 1 while after supplementation this percentage increased to 64.6 percent. While in control group, no significant changes were found at the end of intervention period but the percentage of PLHIV increased from 0 to 10 percent in stage 4 which is clinically not desirable as it indicates HIV wasting syndrome and deterioration in clinical health of PLHIV.

**Effect on Biochemical Parameters**

**CD4 Count:** In both the groups, a significant increase was found at the endline (from 181.7 ± 98.5 cells/cumm to 300.6 ± 203.2 cells/cumm in control group and from 306.5 ± 162.8 cells/cumm to 431.6 ± 206 cells/cumm in experimental group). A greater percentage increase was found in the control group (67%) than in the experimental group (33%). Hence, nutrition supplementation (for eight months) has no added advantage on increasing the CD4 count of PLHIV. It is the ART regimen that plays an important role in maintaining or improving the biochemical parameters.

**Haemoglobin (Hb):** No change was observed in both experimental and control group subjects and the haemoglobin level of control group subjects remained significantly higher than the experimental group subjects (p<0.01) even at the endline. Within the experimental and...
control group also, there was no significant change in the haemoglobin level from baseline to endline (from 10.0 ± 0.8g/dL to 9.8 ± 1.6g/dL in control group and 8.9 ± 1.3g/dL to 8.9 ± 1.3g/dL in experimental group).

**Effect on Anthropometric Profile**

**Weight:** In the control group, a mean decrease of 0.45 ± 7.3 kg in weight was observed while in experimental group there was a mean increase of 0.74 ± 3.2 kg. Within the experimental group, a significant increase (p<0.05) was observed at the end of eight months of supplementation as the weight of the subjects increased from 48.7 ± 8.7kg to 49.5 ± 9.5kg.

**Body Mass Index (BMI):** Within both groups, an increase in BMI, though not significant. Also, in experimental group, the mean increase (0.24 ± 1.2 kg/m2) was a greater than the control group subjects (0.04 ± 1.5 kg/m2). In both the groups, a decline in the percentage of subjects with BMI <18.5kg/m2 (25% to 10% in control group and 49% to 41.5% in experimental group) and an increase in the percentage of subjects with BMI in the normal range i.e. 18.5 – 24.9 kg/m2 (70% to 85% in control group and 47% to 56% in experimental group) was seen at the end of supplementation.

**Waist Circumference:** At endline, in the experimental group, a significant increase in mean waist circumference was evident (p<0.01) (from 70.1 ± 8.2 cm to 72.7 ± 9.3cm). However, in the control group (from 74.1 ± 8.6cm to 74.7 ± 8.7cm) the increase was not significant (p>0.05), as tested by paired t-test.

**Hip Circumference:** Within group analysis shows that in the experimental group, a significant increase was seen from baseline (79.7 ± 5.7 cm) to endline (82.0 ± 6.3 cm) (p<0.01) but in the control group the increase was not significant (82.9 ± 6.3 cm to 83.8 ± 4.5cm) (p>0.05).

**Waist-to-Hip Ratio:** In the control group decrease was found in the mean WHR (from 0.89 ± 0.07 to 0.88 ± 0.01) at the endline while in experimental group an increase was seen (from 0.87 ± 0.06 to 0.89 ± 0.01), though not significant as tested by paired t-test.

**Mid Upper Arm Circumference and Calf Circumference:** Mean MUAC and calf circumference for both experimental and control group subjects increased, the difference being significant (p<0.01) in the experimental group.

**Resting Metabolic Rate and Visceral Fat:** Decline in the mean RMR of control group subjects (from 1307.8 ± 177.8 to 1289.2 ± 168.2 kcal) and an increase in experimental group (from 1247.4 ± 176.5kcal to 1259.1 ± 180.6kcal) as compared to the baseline was reported. At
the endline, a decline in the visceral fat was seen in the control group (from 3.4 ± 2.3 to 3.1 ± 1.9) subjects while no change was found in the experimental group (2.4 ± 1.6 at baseline and endline), though not significant (p>0.05).

**Skeletal Muscle Percentage:** The mean skeletal muscle percentage of the control group subjects decreased to 34.2 ± 9.4 percent from 35.0 ± 8.2 (p>0.05) while in experimental group it remained unchanged at 34.2 ± 8.2 percent.

**Body Fat Percentage:** At the baseline the mean body fat percentage of the control group subjects was 16.0 ± 10.0 (ranging from 4.2 – 41%) which at endline remained unchanged at 16.0 ± 7.9 percent. An increase in the mean body fat percentage was found in the experimental group from 14.2 ± 8.6 percent at baseline to 15.6 ± 9.2 percent at endline(p>0.05).

Overall, nutritional supplementation showed significant improvements in weight, BMI, waist and hip circumference, WHR and MUAC of experimental group subjects. Though, improvements were seen in BMI, waist and hip circumference, MUAC, RMR and skeletal muscle percentages of control group subjects also but the differences were not significant.

**Effect on Mini Nutritional Assessment scale**
In both the groups, maximum percentage of subjects belonged to the At-risk category - 80 percent at baseline and endline in control group and 66.7 percent at baseline and 64.5 percent at the endline in the experimental group. In control group, no change was found in the shift of MNA stages i.e. there were same number of PLHIV in normal, at risk and malnourished category at the endline while in experimental group an increase in “Normal” category of subjects was found at endline (from 6.2% to 11.5%). A decline in the percentage of subjects belonging to “Malnourished” category was seen (from 27.1% to 24%) and in “at-risk” category (from 66.7% to 64.5%).

**Effect on Knowledge, Attitude and Practices Score**
Knowledge: No significant difference in scores were seen at baseline and endline of the control group subjects (decreased from 8.1 ± 1.6 to 7.9 ± 1.6 at endline). However, the mean scores of experimental group subjects increased significantly at the endline (p<0.01) (from 7.3 ± 1.9 to 8.9 ± 1.7).

Attitude: A significant increase (p<0.01) in the mean attitude scores of the experimental group subjects at the endline (from 33.2 ± 3.3 to 34.3 ± 3.1) was seen. While in control group, a significant decline in the mean attitude scores was seen (from 38.3 ± 2.3 to 33.4 ± 2.0) (p<0.001).
**Practices:** Within group analysis indicate a decrease in the mean score of control group (from 7.8 ± 1.7 to 7.5 ± 2.1) (p>0.05) and increase though not significant in the experimental group subjects (from 8.4 ± 2.1 to 8.6 ± 2.0) (p>0.05).

**KAP:** A significant decline in the overall KAP score of the control group by 5.5 ± 3.9 points (from 54.3 ± 3.7 to 48.8 ± 3.6) (p<0.001) and a significant increase in the experimental group subjects by 2.9 ± 3.1 points (from 48.9 ± 4.7 to 51.7 ± 4.5) (p<0.001) was evident.

The act of receiving supplementation could have made the experimental group subjects more sensitive towards receiving the nutritional messages and adapting them to their day-to-day living. The repeated exposures to nutrition related messages (to which control group was not exposed) could have contributed to significant increase in their overall KAP scores.

**Effect on Food Group Intake**

Only in the experimental group subjects, a significant increase was found in the intake of roots and tubers and fruits at the endline (p<0.001). Also, experimental group had intakes higher than the control group for fruits (p<0.05), sugars (p<0.01), other vegetables (p<0.05) and roots and tubers (p<0.01) at endline. In the experimental group, at end line decrease in the intake of cereals and pulses was also observed (p>0.05), which could be attributed to the fact that PLHIV were consuming the NutriPlus powder which was essentially wheat-soya blend and this could have contributed to the decline in cereal and pulse consumption.

**Effect on Mean Nutrient Intakes**

The contribution of the NutriPlus powder was taken into account while calculating the nutrient intakes. A significant increase in the energy (p<0.01), protein (p<0.001), carbohydrate (p<0.01) and fat (p<0.05) intake at the endline was seen among the experimental group subjects. While in the control group, an increase was noted only in fat intakes with no change in carbohydrate and a decrease in energy and protein intake, though differences were not significant. Also, at endline in experimental group subjects, there was a significant increase in the intake of calcium, iron, vitamin B12, thiamine, niacin and riboflavin as compared to the baseline values (p<0.001).

**Effect on Quality of Life**

Within group analysis indicate an increase in all the domain scores for both control and experimental group, however, the increase was significant only in experimental group for physical (from 12.0 ± 2.4 to 12.7 ± 2.3), social relationships (from 11.6 ± 2.0 to 11.9 ± 1.8) and G-facet (from 10.0 ± 2.2 to 12.9 ± 2.9). In the control group, a significant decrease was found in the SRPB domain at the endline (from 16.3 ± 1.3 to 14.8 ± 2.8). Overall, the control group subjects scored minimum on G-facet (i.e. overall quality of life) (12.8 ± 3.0, range
8-16) and maximum on SRPB domain (16.3 ± 3.1, range 9.6 – 20). While, the experimental group subjects scored maximum on SRPB domain (14.6 ± 2.3, range 6-18) and minimum on psychological domain (12.0 ± 2.2, range 4.8-16.8).

Difference between those who consumed the full dose and half dose: CD4 count increased significantly in both the groups i.e.(those consuming 50g/d and those consuming 100g/d (p<0.01) but percentage increase was more in the group that consumed 100g/d (112.2%) as compared to the group that consumed 50g/d (76.2%). Also, a significant increase in body weight was found in the group having the full dose of the supplement (p<0.01). The group consuming 100g/d of supplement indicated a significant increase in BMI (p=0.05) as compared to the group consuming 50g/d (p>0.05).

Thus, the supplementation helped in improving the anthropometric status as indicated by increase in weight, BMI, waist and hip circumferences, WHR, MUAC and calf circumference. Nutritional status was improved at endline with more percentage of PLHIV in the “normal” category as indicated by MNA stages. Intervention also showed significant improvements in the knowledge, attitude and overall KAP scores of PLHIV. NutriPlus powder significantly improved the nutrient intakes by PLHIV as indicated by increase in intake of energy, protein, carbohydrate, fat, calcium, iron, B-group vitamins, copper and zinc. It also showed positive impact on improving the overall quality of life of PLHIV. However, nutrition supplementation in the form of NutriPlus did not showed a significant impact in improving the biochemical parameters of PLHIV (namely CD4 count and haemoglobin).