4

Results and Discussion

The results of the study on **"Impact of Nutrition Interventions on Symptoms of Polycystic Ovarian Syndrome (PCOS) among women of Reproductive age (20-45 Years)"** are presented and discussed under the following headings.

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B) Classification of PCOS women according to the Rotterdam Criteria
C) Socio Demographic profile of the selected PCOS subjects

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PHASE I

A) Incidence of Polycystic Ovarian syndrome among the selected women

Previous studies by (Rachel2020) explained that PCOS was diagnosed among 10 per cent of women in the age group 15-45 years, and 9.1 per cent PCOS patients visited the hospitals for treatments in South India. (Joseph, 2016).Higher prevalence noticed in the age group of 13-20 years (39.25per cent) followed by 27 per cent in the age group of 20-30 years and around 11 per cent in 41-50 year age groups (Cheema et al, 2019) .As per the studies conducted by Gowri and Ramana (2020) higher level of Education in women and those who live in a low income class , unfavourable living and working conditions , increased mental stress and the family lifestyle was associated with occurrence of PCOS . The present survey was conducted among 810 women in the reproductive age of 20-45 years and considered as the study women who were consulted the gynaecologist over the period of two years, January 2019 to December 2020.A quick screening for PCOS was done among Reproductive aged women. Rotterdam criteria (2003) was used to diagnose the Polycystic Ovarian syndrome among the women visited

the gynaecologist in the hospitals for their reproductive health issues other than pregnancy .Out of 810 women screened during the study period, 284 were diagnosed to have PCOS in the 20-45 year age group .In the Indian Scenario a community study reported that the Prevalence of PCOS as 3.7 to 22.5 and varied depending on the area and the group selected for the study (Ganie *et al.,* 2019). An observational study conducted in South India by Nidhi et al,(2011) among the young teenager girls aged between 15 and 18 years concluded that the prevalence of 9.13per cent and one study among adolescents conducted in Kolkata also reported that the prevalence of 28per cent (Chatterjee and Bandyopadhyay (2020).Studies by George and Malini (2013) also confirmed that the unhealthy food pattern in the Central Travancore was considered as the major causative factor that increases the increased prevalence of PCOS up to 33 per cent in the study region. Findings of these studies matches with the present study. In the current research study the prevalence of PCOS in the reproductive age women consulted in the hospital was reported as 35 per cent

B) Classification of PCOS women according to the Rotterdam Criteria

As per the Rotterdam 2003 criteria, the presence of two or more of the below mentioned conditions confirmed the precipitation of PCOS hyperandrogenism and/or hyperandrogenemia (HA);Ovarian dysfunction (Anovulation or oligomenorrhea), Polycystic ovaries in ultrasound scan (Rotterdam ESHRE/ASRM-PCOS Consensus Workshop Group, 2004).NIH 2012 criteria defined any of the two criteria with identification of specific phenotype A).Hyperandrogenism +Ovarian dysfunction+ polycystic ovary morphology B) Hyper androgenism and Ovarian dysfunction C).Hyper androgenism and Polycystic ovary morphology D).Ovarian dysfunction and Polycystic ovary morphology. The classification of selected women according to Rotterdam 2003 is depicted in Figure 9

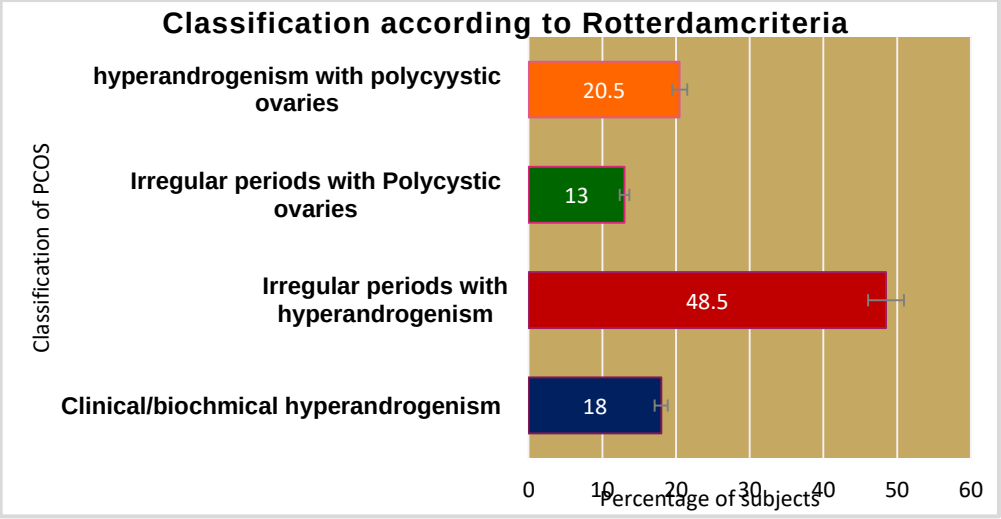

Figure 9 Classification of PCOS subjects (Rotterdam criteria (2003)

As per Figure 7, 48.5 per cent of the selected women were reported to have Irregular periods with Polycystic Ovaries. Nearly 21 per cent of women were presented with Clinical and biochemical hyperandrogenism, Eighteen per cent had the problems of hyperandrogenism with polycystic ovaries. Thirteen per cent had Irregular periods with hyperandrogenism.

C) Socio Demographic profile of the selected PCOS subjects

Average household size of Kerala fall gradually from 5.28 in 1991 to 4.25 in 2011. Studies by Kumar (2014) revealed that 73.3 per cent of the participants were in nuclear families and 26.7 per cent were in joint families system. The urban population of Kerala has a drastic increase and reached up to 50per cent by 2021.The state of Kerala has been registering a faster increase in urban growth rate since 2001 compared to other states in India (Abraham and Santhosh (2021). For the study the data was collected from 284 PCOS women subjects and their socio demographic profile is reported in table IX

Table IX Demographic profile of the PCOS Subjects

Place of Residence	Number of subjects	Per cent of subjects
Urban	95	33.5
Semi urban	161	56.7
Rural	28	9.8
Family type		
Nuclear	207	72.9
Joint	73	25.7
Broken	4	1.4
Marital Status		
Unmarried	102	36
Married	180	63
Separated	2	1
Religion		
Hindu	127	44.7
Christian	129	45.5
Muslim	28	9.8

Table IX reported that majority of the selected subjects (56.7 per cent) were from semi urban areas followed by 33.5 per from urban areas and rest of them (9.8per cent) were from rural areas. Nuclear families reported around 73 per cent in his study (72.9 per

cent) ,joint family up to 26 per cent and 1.4 per cent were from broken family .In the selected subjects, 63.3 per cent were married, 36 per cent were unmarried and meagre(less than one) per cent was separated. Among the 284 PCOS subjects, 127(44.7 per cent) were Hindus 129 (45.4 per cent) were Christians and 28(9.8per cent) were Muslims.

i) Age wise of distribution of the selected PCOS subjects

The mean age of the selected subjects was 29.3±7.1.Nearly 40 per cent of the selected subjects were in the age group of 20-25 years, 19 per cent were in 26-30 year age group, 17.3 per cent in the 31-35 year age group and 23.7 per cent were above 35 years of age (Figure 10). In the younger age groups, PCOS commonly presented with reproductive health issues, as age increases it is more progressed to a metabolic abnormality including decreased energy expenditure, abnormal insulin action. (Lowers and Laven (2020).Figure 10 described the age wise distribution of the selected PCOS subjects.

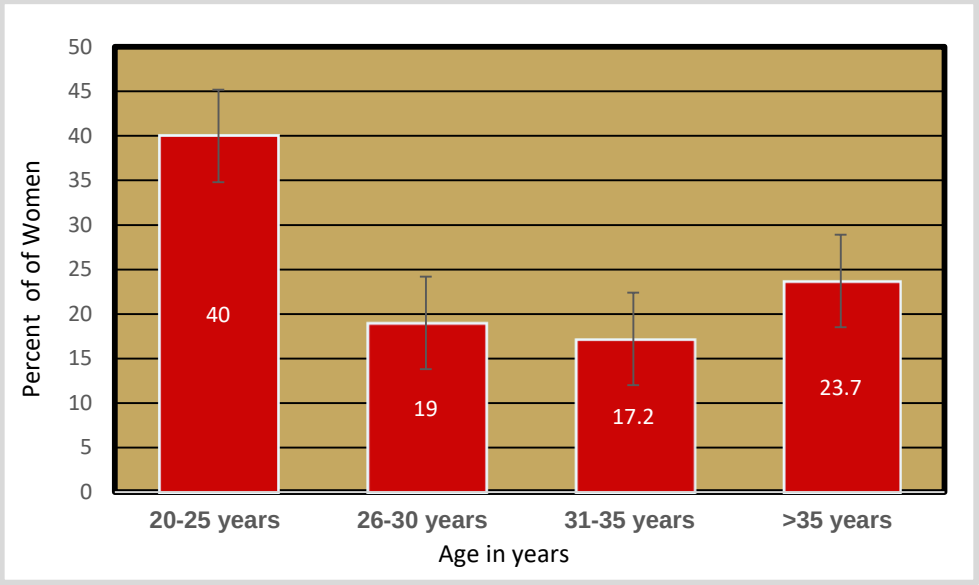

Figure 10 Agewise distribution of the selected subjects (N=284)

ii) Socio economic Profile of the selected subjects

Educational status of Kerala is the top one for education of girls and the female literacy rate in Kerala (92.6 per cent) and highest among other Indian states (Kerala State Mission Authority Report 2020).More than 68.6 per cent of total enrolment for graduation and 75 .5per cent post-graduation in the Universities reported in the years 2014-2015 .So girls in Kerala are well off in terms of Education.

In the present study, it was interested to note that the selected subjects were educated having different levels of higher education in Schools and Colleges .Cent per cent of subjects were having secondary education and above .Table X clearly depicted that majority of the subjects had higher level education, 144 women (50.7) were graduates,

68(23.9 per cent) were post graduates, 4(1.4 per cent) were diploma holders and rest of the 25 per cent had higher secondary and secondary level education. Regarding the occupational status, the Female Work Participation Rate (FWPR) in Kerala is lower than that of other States in India. As per Census 2011, the FWPR of the state has increased by 2.8 points in the last decade. FWPR is lower in four districts of the Kerala including Pathanamthitta, which is lower than that of other States .But still the female work participation rate is only 37.7. In rural areas of Kerala the per cent of female self-employed workers (FSEW) is 3.6.4 and in urban areas it is 36.3, per cent which is also very low compared to other States in India (Saravanaselvi and Pushpa, 2017). in the study

Table X Socio economic profile of the subjects

i)Educational status	Number of PCOS subjects (N=284	Per cent of PCOS subjects
Secondary	9	3.16
Higher secondary	59	20.80
Diploma	4	1.40
Graduation	144	50.70
Post-graduation and above	68	23.94
ii)Occupational status		
Student	45	15.84
Unemployed	121	42.60
Private	107	37.67
Government	9	3.16
Business	2	0.70
iii)Nature of Job		
Housewife/ Not working	167	58.80
Coolie	2	0.70
Clerk	8	2.81
Administrative	1	0.35
Professional	90	31.69
Scholarly	16	5.63
iv)Monthly income (Rs) (Income ≤10,001 to ≥199, 862		
99,931-199,861	5	1.76
74, 755-99,930	7	2.46
49,962-74,755	132	46.47
29,973-49,961	84	29.57
10,002-29,972	41	14.43
<10,001	15	5.28

Source: Modified Kuppuswamy Socio Economic Scale 2020

Table X revealed that only 40.9 per cent of subjects were employed, less than one per cent were involved in business and rest of the subjects were either unemployed (42.6),

or were students (15.8per cent). Majority of subjects (58.8per cent) were home makers. Among the employed women only31.6per cent were employed in professional job, 5.2 per cent were involved in scholarly job, 2.8 per cent were clerk, 0.7 per cent were coolie,0.4 per cent performed administrative work. Table X represents the Socio economic status of the subjects involved. Regarding the economic status of the selected subjects, 46.5 per cent of subjects had a family monthly income between INR of Rs 49,962-74,755. Around 30 per cent had family monthly income between INR of Rs 29,973-49,961. Fourteen per cent has a family income INR of Rs 10,002-29,972.Five per cent had a monthly income was less than INR 10000.

Table XI highlights the Socio economic status of the selected subjects on the basis of Kuppuswamy Socio Economic Scale (2020).

Table XI

Economic status of the selected subjects

Economic Status (Income INR ≤10,001 to ≥199, 862	KSES 2020	Number of subjects	Per cent of subjects
Lower V	<5	5	1.7
Upper Lower IV	5-10	50	17.6
Lower Middle III	11-15	111	39
Upper Middle II	16-25	94	33
Upper I	26-29	24	8.4

The definition of Socio Economic Status (SES) is one's access to social, cultural and human capital resources. Earlier studies have shown that the SES can measure three variables family income, parental education and parental occupational status.The studies by Merkin, et al, (2011) reported that there is a strong association between low childhood socioeconomic status and PCOS , particularly among those who later achieve high personal education primarily those who are obese too .In the present study, 39 per cent of the selected subjects were from lower middle class family and 33 per cent were from upper middle class family, 17.6 per cent from upper lower class and 1.7 per cent was from lower class . About 8.4 per cent of the selected subjects were from Upper class family.

PHASE-II

Nutritional status of the selected subjects

A) Anthropometric measurements of the selected subjects

As per studies by Yucel *et al.,* (2006) PCOS women of reproductive age have increased visceral and abdominal fat compared with the normal control. Women with PCOS had higher total body fat when compared to their age- and BMI matched controls.

Abdominal obesity can be measured as waist hip ratio, WHR), which is a strong risk factor for myocardial infarction and CVD risk (Yusuf et al, 2004).The mean and standard deviation of Anthropometric measurements such as height, weight, Body Mass Index Triceps skin Fold Thickness, Waist circumference, Hip circumference, Waist to Hip Ratio (WHR) and Body fat per cent is given in Table XII.

Table XII Mean anthropometric measurements of the selected subjects

Anthropometric parameters	Minimum	Maximum	Mean	Std. Deviation
Age (years)	20	45	29.3	7.10
BMI	15.3	47.0	28.1	5.70
Height(cm)	140	177.0	157.5	5.77
Weight(kg)	34	128.0	70.04	15.10
Triceps Skin fold Thickness	11.2	53.0	27.30	7.72
Waist Circumference	27.0	51.3	36.12	4.57
Hip Circumference	34.0	55.0	41.82	4.29
Waist/ Hip ratio	.670	.970	.8602	.057
Body fat per cent	10.5	36.0	27.44	4.06

From table XII, It can be concluded that the mean BMI and Body fat was 28.1±5.7 and 27.4±4.06 respectively .Previous studies also explained a higher body fat per cent among PCOS women as high as 30.2 per cent (Sánchez-Ferrer *et al.*2021) which is perfectly in line with the fat per cent of the present study. Among the subjects 83.6 per cent of subjects were presented with a Waist Hip ratio>=0.8 and 16 per cent of subjects were presented with Waist Hip Ratio<0.8

i) Computed BMI values

BMI classification was based on the Asian Classification of BMI and is shown in Figure 11

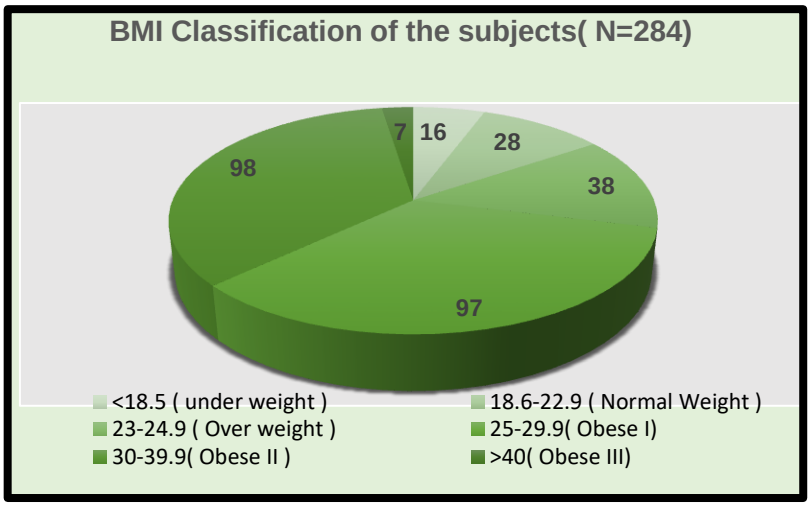

Figure 11 BMI Classification of the Subjects

Nearly three per cent of subjects were Obese grade III or morbid obese category .Majority 98 of the subjects were in obese grade II category (34.5per cent), 97 subjects were in the obese grade I (34.1per cent) , 38 subjects overweight (13.3per cent), 28 subjects were the normal weight category(9.85 per cent) ,whereas 16 subjects were underweight category (5.6 per cent).

B) Clinical Profile related to PCOS

Table XIII reveals the selected 284 subjects Clinical profile related to PCOS

Table XIII

Clinical Profile related to PCOS of the selected women

Clinical profile	Number of PCOS subjects(N=284)	Per cent of PCOS subjects
Hirsutism	128	45.1
Acne	117	41.5
Androgenic Alopecia	136	47.9
Acanthosis	136	47.9
Mood swings	190	47.9
Depression and Anxiety	174	66.9
Sleep disturbance/ Obstructive Sleep apnoea	62	21.8
Frequent Hypoglycaemia	23	8.1
Oligomenorrhea	125	44
Secondary Amenorrhea	3	11.2
Ultrasound polycystic ovaries	188	66
Infertility	49	17.2

The Clinical profiles of the selected subjects is represented in Table XIII .Hirsutism (Clinical features of hyperandrogenism) was present in 45 per cent of subject's and was comparatively lower compared to recent studies carried out by Deswal *et al.,* (2020) showed 58.12 per cent and Muthukumar et al (2021) summarized 69.7 per cent respectively .Acanthosis Nigricans was significant among 47.9 per cent of subjects and androgenic alopecia was also presented among 47.9 per cent of subjects. Acne was presented in 41.5 per cent of subjects. More than 60 per cent of subjects had depression, anxiety and mood swings, the prevalence rate as per previous studies ranges from 14-67 per cent .About 21.8 per cent of subjects had irregular sleep and only 17.9 per cent of subjects had a mildly elevated BP level (=>130/85mmhg). Regarding Ovarian dysfunction 17.2 per cent of subjects had infertility and were undergoing treatment .Recent studies by Muthukumar et al (2021) confirmed that those PCOS subjects who were presented with PCO morphology had significantly higher rates of around 22 per cent of infertility. In the

present study around 66 per cent of women having ultrasound confirmation of Polycystic Ovaries and 17.2 per cent of subjects were suffering from Infertility. Menstrual cycle regularity assessment among the selected subjects confirmed that 44 per cent of subjects were presented with oligomenorrhea and 11.2 per cent of subjects were presented with secondary amenorrhea. Previous studies also confirmed many pregnancy and reproductive complications including subfertility, miscarriage, adverse pregnancy outcome, endometrial cancer related to PCOS (Daan*, et al.,* (2014).

C) Medical history of the subjects

The history of co morbid conditions of the family members of the selected subjects were collected using the validated questionnaire. The details are given in Figure 12

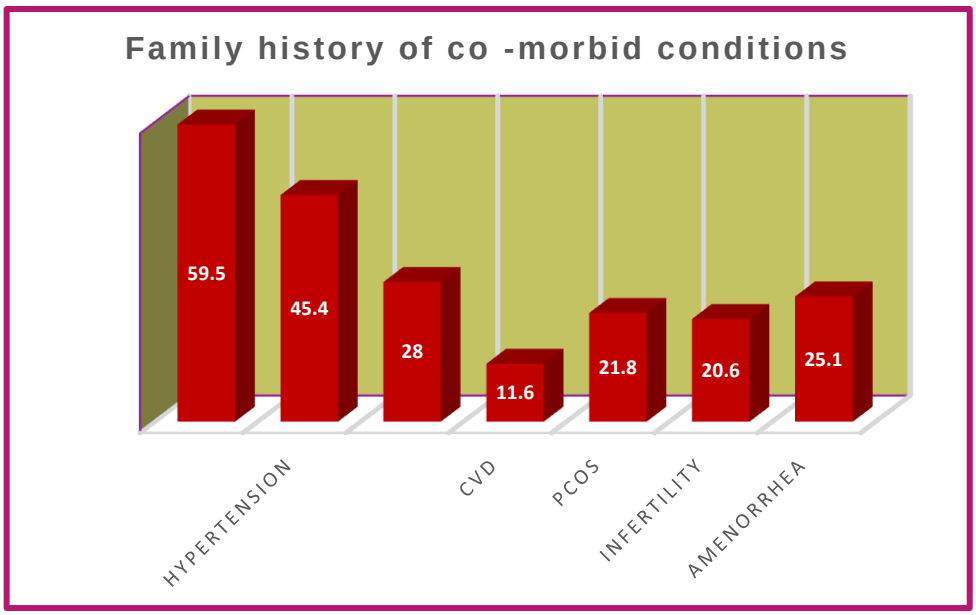

Figure 12 Family history of co morbid conditions of the selected subjects

From figure 12 it can be concluded that, around 59.5 per cent of women had the family history of Diabetes mellitus followed by hypertension (45.4per cent), thyroid disorders (28per cent) and Cardio Vascular Diseases (11.6per cent).Reproductive history revealed that 21 per cent had a family history of PCOS and difficulty in conceiving .Around 25 per cent of the selected subjects had family history of amenorrhea. Gestational diabetes mellitus (GDM) is the most frequently explained as a complication in PCOS subjects with PCOS with a threefold risk, the risk of pregnancy-induced hypertension and preeclampsia. Dyslipidaemia is also very common in PCOS patients (Legro et al., 2001).In the present study nearly three per cent of women encountered Gestational diabetes during their pregnancy periods Figure 11 represented the Blood pressure levels of the selected subjects

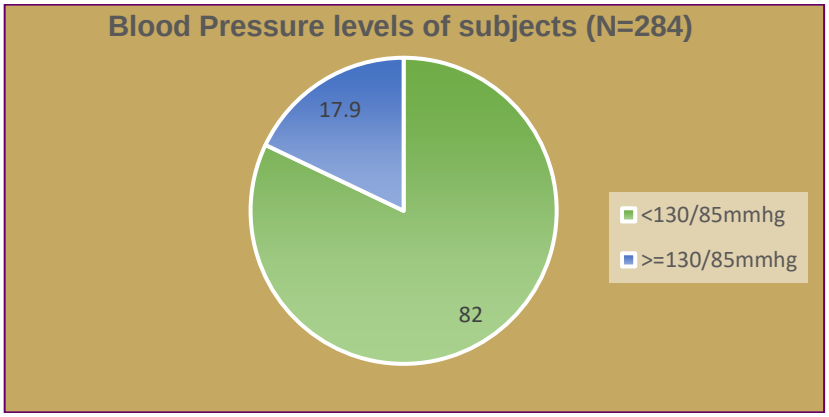

Figure 13 Blood Pressure levels of PCOS subjects

Figure 13 represented that 82 per cent of subjects were having a systolic blood pressure of less than 130mmhg and a diastolic blood pressure less than 85mmhg.Around 17.9 per cent of subjects were presented with a systolic blood pressure of greater than 130mmhg and diastolic blood pressure of greater than 85 mmhg.

D) Mean Nutrient intake of PCOS subjects (N=284)

Table XIV illustrated the mean Nutrient intake of the women between 20years and 45 years and the difference in mean intake compared with the EAR (ICMR/NIN 2020)

Table XIV Mean nutrient intake of the selected PCOS subjects

Nutrient	EAR	Mean intake	T value	P value
Energy (Kcal)	1660	2360±141.1	12.7	0.000
Protein (g)	36.3	70.3±28.0	20.4	0.000
Carbohydrate(g)	130	325.5±141.1	23.3	0.000
Fat (g)	25	79.5±52.	17.6	0.000
Fibre (g)	25	41.5±16.3	17.08	0.000
Soluble fibre (g)	10	8.65±3.7	-6.136	0.000
Folic acid (µg)	180	213±119.9	4.6	0.000
Retinol (mcg)	390	238.1±57.16	-44.8	0.000
Vitamin D (µg)	10	0.88±1.1	-118.3	0.000
Calcium (mg)	800	468.5±217.8	-25.6	0.000
Iron (mg)	15	15.9±7.57	2.0	0.046
Magnesium(mg)	310	367.95±145.4	6.71	0.000
Selenium(µg)	40	59.3±32.3	10.08	0.000
Zinc (mg)	11	7.99±3.03	-0.8374	0.000
Vitamin C (mg)	55	51.8±39.5	-1.33	0.184
Chromium (mg)	0.05	0.07±0.034	10.4	0.000
Potassium (mg)	3500	2586.4±1041.5	-14.7	0.000
Sodium (mg)	2000	2285.1±416.4	11.5	0.000

(EAR: Estimated Average Requirements)

Table XIV indicated that the mean intake of energy and macronutrients were very high compared to the EAR .Carbohydrate, protein, fat shown significant difference between mean value and EAR ($p<0.05$).The mean intake of Micronutrients folic acid, retinol, vitamin D, calcium, magnesium, selenium, zinc, chromium, potassium and sodium had a significant difference compared to EAR ($p=0.00$).Mean Iron intake was significantly differed than EAR at ($p=0.046$).Mean intake of vitamin C had no significant difference between the population mean and EAR ($p=0.184$).The mean intake of calcium was only up to 58 .5 per cent of EAR. Other micronutrients retinol, zinc , potassium was 61 per cent, 72 per cent, 74 per cent respectively and was significantly low in comparison to the estimated average requirement .The mean Vitamin D intake was 88 per cent lesser than the estimated average requirement. The mean intake of some of the micronutrients was higher when compared to EAR .The mean intake of some micronutrients were higher when compared to the EAR, those micro nutrients were Iron (6 per cent), Selenium (48 per cent), sodium (14 per cent), magnesium (18.6per cent) and chromium (40 per cent).The mean calorie intake was 42 per cent higher than the EAR . Carbohydrate, fat and protein intake was also significantly higher than the EAR by 150 per cent, 127 per cent and 94 per cent respectively .Total fibre intake was 66 per cent higher than the EAR where as soluble fibre intake was 86 per cent lower than the estimated average intake. The lacunae in the micro nutrient intake was considered and the supplement was standardised to get at least $1/3^{rd}$ to $1/7^{th}$ of the daily micronutrient requirements in one serving.

Phase III

Formulation and evaluation of Micro Nutrient dense Supplement Powder

A) Formulation cum evaluation of Nutrient dense health mix Supplement

The best remedial measure for lifestyle disorders is a well-structured diet plan. Supplementation and education is considered as the most relevant method to recommend for balancing the nutrient intake .Nutritional supplements were prepared using the ordinarily obtainable indigenous ingredients in the market, low cost, easily available for ease of preparation. All these factors taken into consideration for preparing a Nutrient dense supplement which is expected to maintain good reproductive health resolving problems related to ovulation, induce ovulation, menstruation correction, improvement of metabolic profile and biochemical values in PCOS subjects. Many studies on PCOS focused on minerals supplementation to prevent or minimize the pathologic situations from PCOS.

B) Sensory evaluation of Nutrient dense health mix supplement using hedonic scale

A Nine point hedonic scale was used for sensory evaluation in terms of appearance, colour, taste , flavours and texture and Grades were given according to the degree of acceptance by the selected taste panel member .Scores secured in the Sensory evaluation of the nutritional supplement is given in TableXV.

Table XV Mean Scores of the supplement in different variations m

Properties	Scores of the variations				
	Variation I	**Variation II**	**Variation III**	**Variation IV**	**Variation V**
Appearance	6.5	6	8.1	6.3	5.5
Taste	6.3	5.6	7.5	6.6	6.0
Colour	6.5	3.25	6.75	6.25	6.2
Flavour	6.6	4.3	7.3	6.75	6.2
Texture	6.5	2.8	8.1	5.7	5.5
Mean Score	6.48	4.38	7.55	5	5.8

Results from Table XV confirmed that Variation III secured the highest mean score of 7.55 for all sensory properties followed by variation I with a mean score of 6.48, and were named as Formula I and Formula II

C) Nutrient content of the supplement

Five variations of the supplement were prepared and considered for sensory evaluation. The two variations which got the highest scores were chosen for nutrient analysis. The acceptability of the best two variations were tested after preparation of different types of porridges. Each of the variations were supplied as 30g as one feed .Variation I and III of supplement were used for the preparation of porridges and used for analysis of the nutrient content suggested by ICMR-NIN Laboratory Manual (2020).The selected two variations of nutritional supplement were considered. The nutrient content of Formula I and Formula II is represented in Table XVI.

Table XVI Nutrient Content of the Nutrient dense health mix supplement

Nutrients	**Formula I**	**Formula II**
Energy (Kcal)	471.64	446.47
Protein (g)	15.3	18.8
CHO (g)	34.9	32.2
Fibre (g)	11.9	13.3
Fat (g)	30.04	26.8
Iron (mg)	4.76	5.21
Calcium (mg)	417.63	446.47
Magnesium (mg)	235.14	188.02
Zinc (mg)	4.06	4.08
Thiamine (mg)	0.327	0.275
Riboflavin (mg)	2.7	4.19
Niacin (mg)	1.75	2.88
Vitamin B5(mg)	4.52	16.88
Retinol (µg)	0.803	0.773
Omega 3 fatty acid (mg)	2643.6	2004.7
VitaminE(µg)	3.6	3.8
Folate (µg)	51.77	54.8

Nutrient content of the health mix supplement per 100g is represented in table XVI .Both the supplements were having almost similar nutrient content especially calories , carbohydrate, vitamin E ,Zinc ,vitamin A . However Formula II was comparatively high in protein(18.8g), fibre(13.3g), calcium (446mg), iron (5.2mg), Vitamin B2 (4.19mg) and vitamin B5 16.8mg.

D) Microbial count and cost effectiveness

Plate count verification of the nutritional supplement variation I and variation III was carried out in the microbiology laboratory using the procedure of Total Aerobic Microbial count (TAMC) IP(2018 (Volume -1) pg no -38 , The reference range is 0 to 10^4 cfu / g The result of the score was tabulated. The microbial count gave valuable information on the shelf life and keeping quality of the supplement prepared without much processing. The shelf life of the formulas were analysed in the first month, second month and third month .After one month, the first evaluation was conducted, and the plate counts for formulas I and II were 1.2X104 and 1.8X104 cfu/g, respectively. The plate count was "1.7x104 Cfu/g for Formula I and 2.0x104 Cfu/g after the second and third months, respectively, while for formula II, the plate count was 2.1x 104 cfu/g and 2.3x 104 cfu/g. Participants were instructed to store the preservative-free supplement in the refrigerator for the duration of 90-day supplementation period.The ingredients used in the nutritional supplement were locally available, low cost and were rich in micronutrients .These ingredients were procured from the local market and cost of the formula I and II were calculated to know about the cost effectiveness.300g (1 packet) of formula I supplement costs Rs 132 and Formula II costs Rs 129 which was comparatively cost effective to commercial medical management formula.

PHASE IV

Distribution of Participants for Nutrition intervention

Among the participants selected by Rotterdam criteria, 93 participants were selected by purposive sampling method. Thirty subjects taking medications and were selected as the control group only for comparison. Remaining 63 subjects were randomly selected for the Intervention using fish bowl technique. After the selection of the participants for the study they were systematically grouped to know the difference in baseline characteristics. Table XVII represented the socio demographic profile of subjects

Table XVII The socio demographic profile of the selected participants of the Intervention study

Residence	Frequency(n=93)	Per cent	Cumulative Frequency	Cumulative per cent
Rural	9	9.68	9	9.68
Semi urban	66	70.97	75	80.65
Urban	18	19.35	93	100
Family type				
Nuclear	62	66.67	62	66.67
Joint	29	31.18	91	97.85
Broken	2	2.15	93	100
Family size				
2-3	23	24.73	23	24.73
4-5	55	59.14	78	83.87
>5	15	16.13	93	100
Education				
Primary	1	1.08	1	1.08
Secondary	3	3.23	4	4.3
Higher secondary	11	11.83	15	16.13
Diploma	3	3.23	18	19.35
Graduation	48	51.61	66	70.97
Post-graduation	27	29.03	93	100
Occupation				
Unemployed	28	30.11	28	30.11
Student	28	30.11	56	60.22
Private	35	37.63	91	97.85
Government	2	2.15	93	100

A) Socio Demographic profile of the selected PCOS subjects for Nutrition Intervention study

Table XVII represented the socio economic profile of the selected PCOS individuals. After systematic grouping of the selected subjects, grouped subjects involved in nutrition intervention were termed as participants. Rotterdam criteria was used to diagnose PCOS and 93 participants were selected for the intervention study using purposive Sampling technique. Table XVII explained that most of the selected participants were residents of semi urban area (70.9 per cent) which is consistent with the study conducted in Haryana where 71 per cent of subjects with PCOS reside in urban regions, while 29per cent in rural areas (Broekmans 2006).Among the participants selected for the interventions, nearly 10 per cent resided in rural areas while 19.35 per cent and rest of them were resided in the semi urban areas. The PCOS varies depending on the trait and area of residence. Among the family type, most of the selected PCOS participants were

belonged to nuclear families (66.6 per cent), while 31per cent belonged to joint family system and nearly three per cent of participants belonged to broken family .Around 59per cent were comprised of a family size of 4-5 members, and rest of the participants had less than four members or more than five in their families

a) Educational qualification of the selected Participants

Table XVII also specified that 52 per cent of PCOS participants in the intervention studies were graduates 29 per cent were post graduates three per cent ,were qualified diploma were qualified with the degree of diploma,12 per cent, completed higher secondary school education and rest of them had the secondary school education.

b) Occupational status of the selected PCOS participants

Table XVII also mentioned that the occupational status of the selected women participants involved in the study groups .Among the selected participants, 30 per cent were unemployed, 30 per cent were students and 40 per cent were employed of which two per cent were in government service and 38 per cent were employed in private sectors.

c) Economic profile of the selected PCOS participants

Figure 14 pointed out the Economic status of selected participants of the intervention study .Economic classification was executed using Kuppuswamy Socio Economic Scale (2020). Among the selected participants 43 per cent of women belonged to lower middle class, 36.5 per cent were upper middle class, 5.3 per cent were upper class and remaining 15 per cent were from upper lower class .Recent studies demonstrated the relationship between low socioeconomic status in childhood and the increased PCOS.Recent studies demonstrated the relationship between low socioeconomic status in childhood and the increased PCOS risk among those who attained higher education (Gowri and Ramana, (2020)

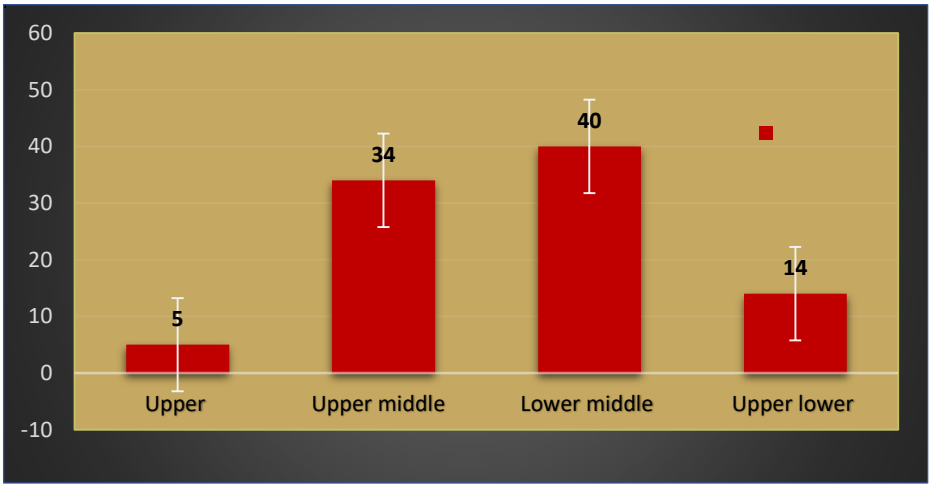

Figure 14 Economic Status classification of the Participants

B) Distribution on the basis of demographic profile

Table XVIII shows the distribution of PCOS participants based on socio economic characteristics such age, religion, marital status, and socioeconomic class.

Table XVIII Distribution of Intervention participants based on Demographic profile

AGE	Frequency	Expt I	Expt II	Control	Per cent	Cumulative Frequency	Cumulative Per cent
20-29	68	24	20	24	73.12	68	73.12
30-39	24	8	11	5	25.81	92	98.92
40-45	1	0	0	1	1.08	93	100
RELIGION							
CHRISTIAN	49	17	17	15	52.69	49	52.69
HINDU	36	11	12	13	38.71	85	91.4
MUSLIM	8	4	2	2	8.6	93	100
MARITAL STATUS							
MARRIED	51	16	12	23	54.84	41	44.09
SINGLE	41	15	19	7	44.08	92	98.92
SEPARATED	1	1	0	0	1.08	93	100
SOCIO ECONOMIC CLASS							
Upper	5	2	3	0	5.38	5	5.38
Upper middle	34	13	7	14	36.56	39	41.94
Lower middle	40	12	16	12	43.01	79	84.95
Upper lower	14	5	5	4	15.05	93	100

Table XVIII showed that the 93 participants chosen for the study were between the ages of 20 and 45 years, 52 per cent of the study group's chosen individuals identified as Christians, 39 per cent as Hindus, and 9 per cent as Muslims. The participants' marital status showed that 55 per cent of them were married, 44per cent were unmarried, and 1per cent was separated. According to socioeconomic classification, 43 per cent of women came from Lowe middle-class families, 37 per cent from upper middle-class families, 15 per cent from upper lower-class families, and 5 per cent from upper-class families

C) Pre-intervention distribution of women according to anthropometric measurements

Table XIX represented the distribution of participants on the basis of BMI criteria for Asians and Waist Hip Ratio (WHR) was also used for grouping of the participants for nutrition intervention

D) Distribution of Participants on the basis of biochemical and clinical symptoms of PCOS

Table XIX represented the Distribution of participants on the basis of biochemical and clinical profile such as elevated testosterone levels, presence of hirsutism, ovarian cyst on Ultrasound scan, regularity of the menstrual cycle and presence of acne.

Table XIX Distribution of Participants based up on anthropometric, biochemical & clinical profile

BMI					
	18.5-22.9	23-24.9	25-29.9	30-39.9	>40
Experimental I	1	2	13	13	1
Experimental II	1	2	12	14	2
Control	1	2	15	13	1
WAIST HIP RATIO					
	<=0.8		>0.81		
Experimental I	5		25		
Experimental II	8		23		
Control	2		30		
HIRSUTISM					
Study groups	PRESENT		ABSENT		
Experimental I(N=32)	24		8		
Experimental II(N=31)	21		10		
Control(N=30)	27		3		
OVARIAN CYST					
	PRESENT		ABSENT		
Experimental I (N=32)	24		8		
Experimental II(N=31)	29		2		
Control(N=30)	27		3		
INCREASED TESTOSTERONE LEVEL					
	<=.59		>0.59		
Experimental I (N=32)	20		12		
Experimental II(N=31)	23		8		
Control(N=30)	17		13		
REGULARITY OF MENSTRUAL CYCLE					
	REGULAR		IRREGULAR		
Experimental I(N=32)	6		26		
Experimental II(N=31)	6		25		
Control(N=30)	4		26		
ACNE					
	PRESENT		ABSENT		
Experimental I(N=32)	15		17		
Experimental II(N=31)	19		12		
Control(N=30)	19		11		

The distribution of participants in the study groups was noted in Table XIX. 3.3per cent of participants had a BMI of 18.5-22.9 kg/m2. 6.5per cent were below 23 kg/m2, 43.5per cent were between 25 and 29 kg/m2, 53.7per cent were between 30 and 39 kg/m2, and 4.3 per cent were above 40 kg/m2. Waist Hip Ratio was less than 0.8 for 16.1per cent of individuals and more than 0.8 for 83.8per cent. Nearly 77 per cent per cent of participants had the problem of hirsutism and 32 per cent of participants were did not have the problem of hirsutism. In the Experimental group I , 75 per cent of participants were suffered with polycystic ovaries, 37.5 per cent had the problem of increased testosterone levels, 81.2 per cent experienced with the painful situation of menstrual irregularity, and 46.8 per cent had problems due to acne. In the Experimental group II, 67.7 per cent of participants had hirsutism, 93.5 per cent of participants had ovarian cyst, 25.8 per cent had the problem due to increased testosterone levels, 80.6 per cent with menstrual irregularity 61.2 per cent with presence of acne. Control group 90 per cent of selected participants presented with hirsutism and ovarian cyst, 43 per cent had increased testosterone levels, 86.6 per cent had menstrual irregularity and 63.3 per cent had acne as the major reproductive health issue

i) Distribution of participants based on the level of Hirsutism

Figure 15 sketched out the distribution of the participants based on the level of hirsutism . In the Experimental groupI , 18 participants had mild hirsutism and six participants had moderate hirsutism and eight of the participants did not have hirsutism .In the Experimental group II, 15 participants had mild , six had moderate and 10 of them had no signs of hirsutism. Among the Control group, 18 participants had mild hirsutism , nine had moderate and three of them did not have hirsutism

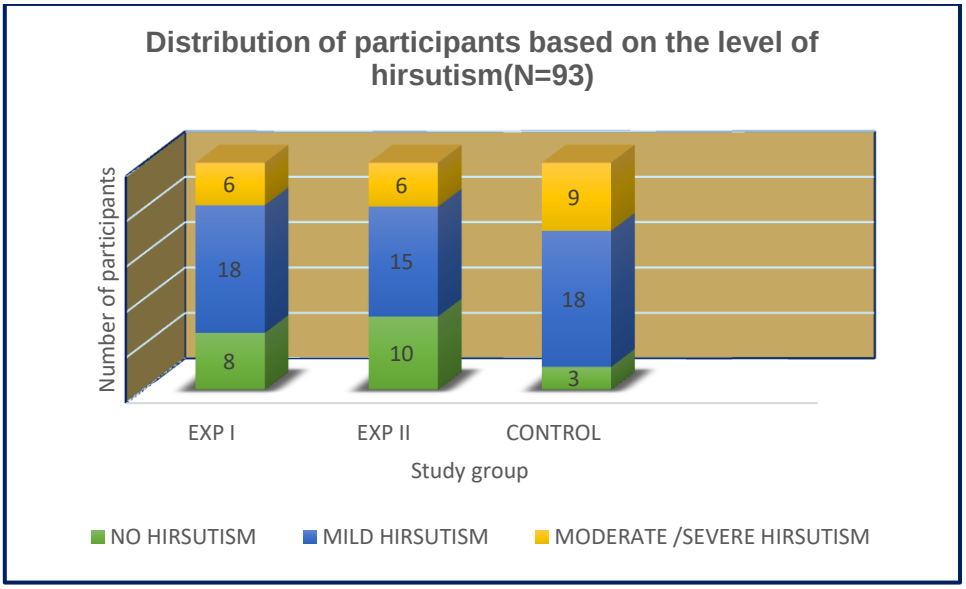

Figure 15 Distribution of participants on the basis of level of Hirsutism

ii) Distribution of participants based on the level of Acne

Participants were distributed on the basis of the level of acne , using Global acne Grading system Distribution of participants based on the severity of acne is represented in Figure 16

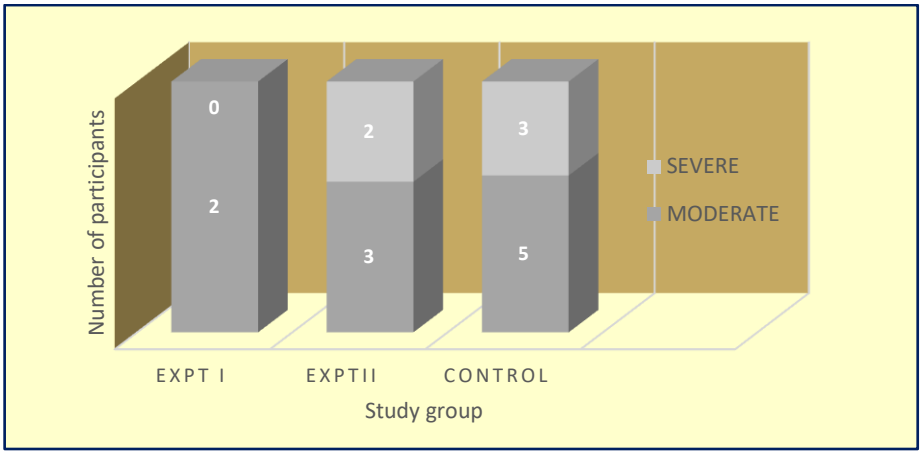

Figure 16 Distribution of participants on the basis of Severity of acne

From Figure 16, it is noted that 13 participants had mild acne , two participant had moderate acne among the Experimental groupI .No one in the Experimental group I had severe acne scores . In the Experimental groupII,14 participants had mild acne ,three participants suffered from moderate level of acne and two participants had severe acne scores. In the Control group, 11 participants had mild acne score followed by five participants with moderate and three participants with severe acne score.

iii) Distribution of participants s based on the presence of ovarian cyst

Figure 17 clearly illustrated the distribution of participants on the basis of presence of ovarian morphology on ultra sound scan.

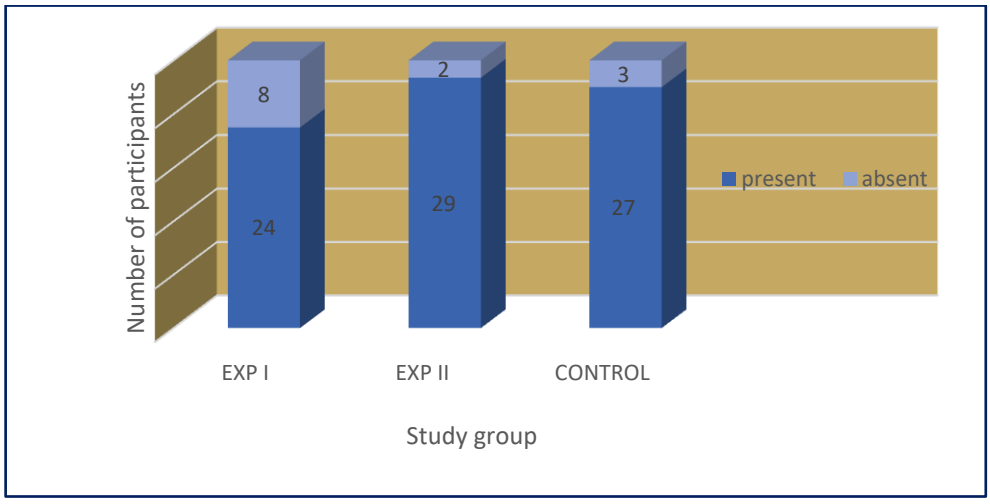

Figure 17 Distribution of participants based on the basis of Ovarian cyst

Figure 17 showed that 25per cent of the Experimental group I had no ovarian cysts on USG and that 75per cent of them had PCOM morphology on scan. 95 per cent of individuals in the Experimental group II and 90 per cent of participants in the Control group had cysts on their USG scans. Nearly six per cent of participants of the Experimental group II and 10 per cent of participants of the Control group did not present with PCO morphology on ultrasound scan

E) Distribution of participants based on the Stress level

Figure 18 depicted the stress level of participants in each of the intervention study groups .Most of the participants were suffered from moderate stress. Among the Experimental group I, six per cent of participants had mild stress, 81.2 per cent of participant had moderate stress and nearly 13 per cent of women were presented with severe stress. Experimental II and Control participants had mild stress with nearly 7 per cent and 10 per cent, moderate stress with 67.7 per cent and 66.6 per cent, severe stress with 25.8 per cent, 23.3 per cent respectively. In the Experimental group I, 6.2 per cent of participants were in mild stress level, 81. 2 per cent were in moderate stress and 12.5 per cent were in the severe stress level. In the Experimental group II, 6.4 per cent had mild, 67.7 per cent had moderate, and 25.8 per cent had severe stress. Among Control group, 10 per cent had mild, 66.6 per cent had moderate and 23.3 per cent had severe stress level. Figure18 clearly indicated the severity of stress level in the participants.

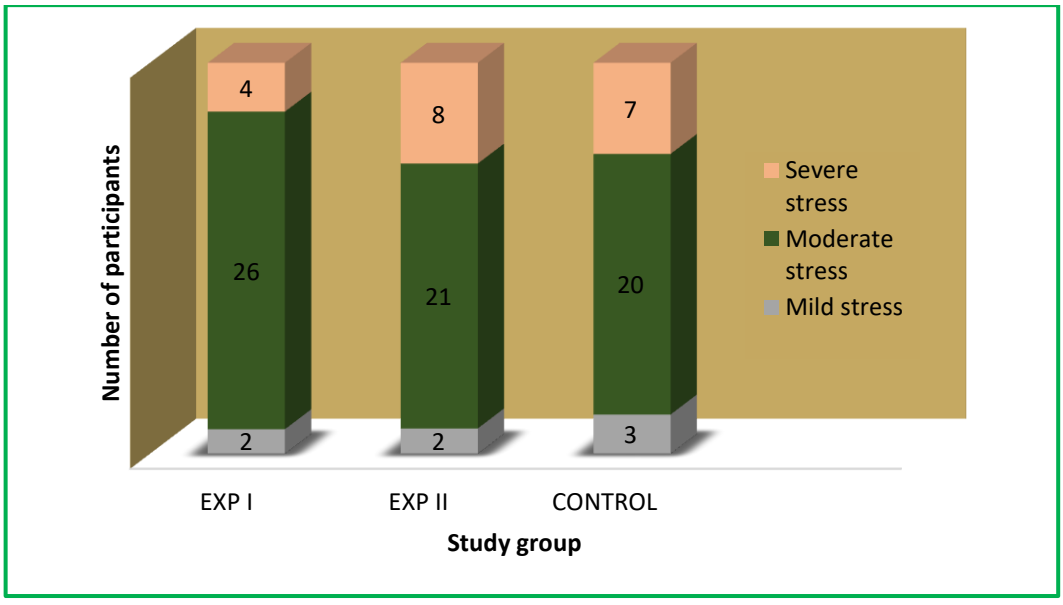

Figure 18 Distribution of participants on the basis of stress level

F) Distribution of participants based on the level of menstrual irregularity

Figure 19 outlined the distribution of participants based on their menstrual cycle regularity.

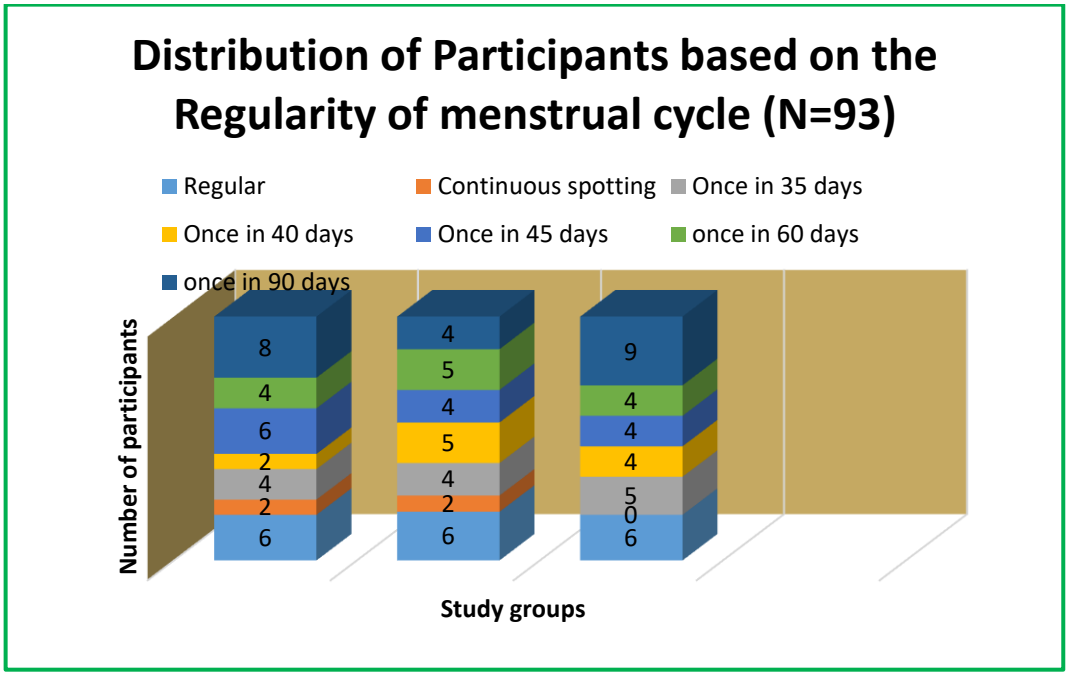

Figure 19 Distribution of participants based on the regularity of menstrual cycle

Among the participants in the three study groups, six participants had normal menstrual cycle. In the Experimental group I and Experimental group II, two participants had continuous spotting, four participants had their menstrual cycle every 35 days. In Control group 5 participant had menstrual cycle every 35 days .Two participant from the Experimental I group, five participant from the Experimental II group and four participant from the Control group had menstrual cycle every 40days. Each four participant from Experimental II and Control had menstrual cycle every 45 days and six participant from Experimental I had every 45 days. Menstrual cycles was repeated after 60 days in four participant from Experimental I and Control group where as five participants in the Experimental II were repeated the menstrual cycle every 60days .Eight participant from Experimental I group had menstrual cycle after 90 days and /or more than 90 days , four participants from Experimental II and nine from Control and 8 women from the Experimental I group were having menstrual cycle every 90 days , four women from Experimental II and nine participants from Control had menstrual cycle after 90 days and /or more than 90 days.

Phase V Impact of Nutrition Interventions on the Symptoms of PCOS and Nutritional status of the study participants

A) Impact of the nutrition interventions on anthropometric measurements

The effect of three types of nutrition interventions on nutritional status was assessed and represented in Tables XX, XXI, and XXII

a) Mean Anthropometric measurements

In Table XX, average anthropometric dimensions are shown. The Experimental group I mean age was 25.97 ± 4.78, the Experimental group II mean age was 27.84± 5.38, and the Control group mean age was 25.00± 5.45. The mean BMI for Experimental Group I was 29.95± 4.35, for Experimental Group II was 30.82± 5.82, and for Control Group was 30.43± 4.1. The mean waist size for the Experimental group I, Experimental group II, and Control group was 36.73 ±3.12, 37.97± 4.10, and 36.22± 4.90 respectively

Table XX Mean Anthropometric measurements of the participants in the intervention study

Variables	Expt I (N=32)	Expt II (N=31)		Control (N=30)	
	Mean ± SD	Mean ± SD	Pr > |t|	Mean ± SD	Pr > |t|
Age(years)	25.97 ± 4.78	27.84 ± 5.38	0.1496	25.00 ± 5.45	0.4592
Height (cm)	158.00 ± 4.50	156.60 ± 7.08	0.3545	156.70 ± 4.83	0.2783
Weight (Kg)	74.77 ± 10.50	75.65 ± 16.27	0.7983	74.73 ± 12.11	0.9893
BMI(Kg/m²)	29.95 ± 4.35	30.82 ± 5.82	0.5035	30.43 ± 4.18	0.6622
TSF(mm)	27.98 ± 6.69	27.55 ± 7.62	0.8099	27.77 ± 7.25	0.9025
Waist Circumference(In)	36.73 ± 3.12	37.97 ± 4.10	0.1799	36.22 ± 4.90	0.6311
Hip Circumference(In)	41.90 ± 3.47	43.39 ± 4.04	0.121	41.81 ± 4.58	0.9305
Body fat(per cent)	35.85 ± 7.68	39.26 ± 6.86	0.0682	35.77 ± 7.98	0.9681
Body water (per cent)	52.55 ± 2.53	51.55 ± 3.35	0.1843	52.09 ± 2.48	0.4793
Visceral Fat(Kg)	9.30 ± 1.73	9.60 ± 2.66	0.5923	9.39 ± 1.81	0.8423

Age, weight, BMI, TSF, WC, HC, body fat, body water, or visceral fat (P>0.05) showed significant difference between the participants in the three study groups, indicating that all anthropometric characteristics were equivalent at baseline.

Anthropometric measurements of the participants before Intervention

Table XX(a) indicated the median values of the anthropometric measurements of the three intervention groups before intervention .The variability can be expressed as Interquartile Range (IQR) .The median of weight of Experimental group I was 72.0(IQR 65.33-79.10), Experimental group II was 70.50(IQR 65.55-84.25),Control was72.6(IQR 62.70-83.10). For BMI the median in the Experimental group I was 28.9 (IQR 26.87-33.67), Experimental group II was 30.0(IQR25.80-35.3), Control group was 29.8(IQR27.50-33.45).The triceps skinfold thickness was 27.0(IQR 23.5-32.0)for Experimental group I ,27.0(IQR 23.0-30.0) for Experimental group II and 27.50(IQR 23.7-32.62).The median value for waist circumference in the Experimental group was 36.10 (IQR 34.62-39.80) followed by 38.0(IQR 35.0-41.0) in the Experimental group I and 35 (IQR 32.5-38) Control group. Hip

circumference was 42.0(IQR 39.0-44.90) in the Experimental group, 43.0(IQR40.5-45.0) in the Experimental group II and 41.0(IQR 38.8-43.8) .The median value for body fat in the Experimental group I was 39.5(IQR 26.8-39.55),Experimental group II was 40.9(IQR 36.1-44.9) and control group was 40.9(IQR 26.8-41.85)

Table XX (a) Anthropometric measurements of the participants before Intervention

Intervention group	Weight		BMI		TSF		WC		HC		Body fat	
	Median	IQR	Median	IQR	Median	IQR	Median	IQR	Median	IQR	Median	IQR
Experimental group I	72.0	13.8	28.9	5.9	27.0	8.9	36.1	5.5	42.0	4.9	39.6	14.4
Experimental group II	70.5	18.7	30.0	6.8	27.0	8.5	38.0	5.2	43.0	5.9	40.9	15.1
Control	72.6	20.4	29.8	9.5	27.5	7.0	35.0	6.0	41.0	4.5	40.1	8.4

b) Effect of Nutrition intervention on Anthropometric measurements of the participants in the Experimental group I

Effect of Nutrition Intervention on anthropometric measurements of the selected participants is depicted in Table XXI. Among the 93 participants, 30 participants in the control group were given allopathic medications, 31 participants in the Experimental group II were provided nutrition education and 32 participants in the Experimental group I were given standard diet plan with nutritional supplement for 90 days, Effect of Nutrition intervention on anthropometric measurements in the Experimental group I is given in Table XXI.

Table XXI Effect of Nutrition intervention on Anthropometric Measurements of the participants in Experimental group I

Anthropometric measurements	Mean +SD Before	Mean +SD After	Mean difference	SD	Std. Error Mean	T value	Sig. (2-tailed)	S/NS
Weight (Kg)	74.77 ± 10.50	70.05 ± 10.43	4.72	2.64	0.47	10.10	.000*	S
BMI(Kg/m²)	29.95 ± 4.35	28.05 ± 4.27	1.90	1.07	0.18	10.09	.000*	S
Total skin fold thickness(mm)	27.98 ± 6.69	26.49 ± 5.82	1.50	2.25	0.40	3.76	.001*	S
Waist Circumference(in)	36.73 ± 3.12	35.18 ± 3.62	1.55	1.21	0.21	7.26	.000*	S
Hip circumference(in)	41.90 ± 3.47	40.82 ± 3.45	1.08	1.09	0.19	5.63	.000	S

Anthropometric measurements	Mean +SD Before	Mean +SD After	Mean difference	SD	Std. Error Mean	T value	Sig. (2-tailed)	S/NS
Waist Hip Ratio	0.85±0.06	0.85±0.05	0.002	0.03	0.005	0.43	0.670	NS
Body fat (per cent)	35.85 ± 7.68	34.32 ± 7.93	1.54	1.18	.208	7.377	.000*	S
Body water (per cent)	52.55 ± 2.53	52.56 ± 2.40	-.0125	1.74	.3081	-.041	.968	NS
Visceral fat (Kg)	9.30 ± 1.73	8.83 ± 1.96	.465	.723	.1278	3.642	.001*	S

Table XXI described the effect of nutrition interventions in terms of anthropometric measurement .Weight loss was obvious and the results of the paired sample t test were significant (31) =10.09, p<0.001, indicated that there was a substantial reduction in the weight from pre intervention weight (M=74.77, SD 10.77, N=32) to post test (M=70.05, SD =10.43, N=32).The effect size was large based on Cohen's conventions (1988). The mean decrease was 4.7 ± 2.64kg (5.9 per cent),which was highly significant (p=0.000) with a t value 10.10 .The analysis of the results specified that there was a significant decrease in BMI after the Nutrition intervention (M=28.05,SD = 4.27, N=32), t(31)= 10.09 ,p=0.000, at best line the value was (M=29.95,SD= 4.35, N=32). Among the three intervention group, the Experimental I group had a larger drop of 1.49±2.254 mm (t=3.756, p=0.001), mean change in Triceps Skinfold thickness. It was intriguing to observe in the Experimental group I that there was a significant weight loss, which was followed by decreases in BMI, waist circumference, hip circumference, body fat, and visceral fat levels (p 001). The average decrease in weight, BMI, TSF, waist, hip, and body fat measurements was 4.72kg, 1.9 kg/m2, 1.5 mm, 1.55 in., 1.08 in., and 1.54 per cent respectively. Water per cent in the body (p=0.968) and WHR (p=0.670) did not differ significantly from one another.

c) Effect of Nutrition Education on anthropometric measurements of Participants in Experimental group II

Table XXII demonstrated the effect of nutrition education on anthropometric measurements of the Experimental group II .Paired sample t test was used to evaluate the statistically significant difference existed between the mean values of anthropometric measurements before and after nutrition interventions**.**

Table XXII indicated that there was a significant moderate reduction (p=0.000) in weight among Experimental group II by 1.9±2.11kg (2.5 per cent). From the above table, it is evident that there was a significant difference between anthropometric measurements before and after the Nutrition education in the Experimental group II. Experimental group II had significant decrease of Triceps skinfold thickness of 0.55±0.847mm (t=3.58, p=0.001).

Weight, BMI, TSF, and body fat all significantly decreased (p 0.001) from 1.92 to 2.12 kg, 1.07 to 0.25 kg/m2, 0.55 to 0.85 mm, and 0.72 to 0.83%, respectively. In the Experimental group II, there was no discernible difference in the values of waist circumference and hip circumference (p>0.05) ,WHR (P=0.446), or body water (p=0.682) before and after nutrition education.

Table XXII Effect of Nutrition education on Anthropometric measurements of participants in Experimental group II

Anthropometric measurements	Mean +SD Before	Mean +SD After	Mean difference	SD	Std. Error Mean	t value	Sig. (2-tailed)	S/NS
Weight (kg)	75.65 ± 6.27	73.73 ± 16.21	1.922	2.118	.3803	5.055	.000*	S
BMI(Kg/m^2)	30.82 ± 5.82	29.82 ± 5.73	1.00	1.27	.22821	4.398	.000*	S
Total skin fold thickness(mm)	27.55 ± 7.62	27.00 ± 7.35	.545	.848	.1522	3.581	.001*	S
Waist Circumference(cm)	37.97 ± 4.10	37.84 ± 4.75	.129	1.5219	.2733	.472	.640	NS
Hip Circumference(cm)	43.39 ± 4.04	43.22 ± 4.19	.167	1.510	.2713	.618	.541	NS
Waist Hip Ratio	0.87±0.05	0.86±0.05	0.003	0.020	.004	.772	.446	NS
Body fat (%)	39.26 ± 6.86	38.54 ± 6.79	.719	.834	.1498	4.802	.000*	S
Body water (%)	51.55 ± 3.35	51.63 ± 3.05	-.087	1.173	.2106	-.414	.682	NS
Visceral fat(Kg)	9.60 ± 2.66	9.44 ± 2.60	.455	1.713	.3076	1.479	.150	NS

* Significant at 0.05 level NS – Not Significant. S – Significant

d) Effect of Medication on Anthropometric measurements of Participants in the Control group

The effect of medication intervention on anthropometric measurements of PCOS participants were shown in Table XXIII.

Table XXIII Effect of Medication on anthropometric parameters of PCOS participants

Anthropometric measurements	Mean +SD Before	Mean +SD After	Mean difference	SD	Std. Error Mean	t value	Sig. (2-tailed)	S/NS
Weight(Kg)	74.73 ± 12.11	74.91 ± 11.32	-.1767	3.4908	.6373	-.277	.784	NS
BMI(Kg/m^2)	30.43 ± 4.18	30.53 ± 4.07	-.1000	1.3046	.2382	-.420	.678	NS
Total skin fold thickness(cm)	27.77 ± 7.25	27.80 ± 6.99	-.0300	1.1724	.2141	-.140	.890	NS
Waist Circumference(cm)	36.22 ± 4.90	36.21 ± 4.34	.0100	1.2796	.2336	.043	.966	NS
Hip Circumference(cm)	41.81 ± 4.58	41.99 ± 4.18	-.1767	1.1584	.2115	-.835	.410	NS
Waist Hip Ratio(cm)	0.88±0.04	0.87±0.04	.011	0.02	.004	3.173	.004*	S
Body fat(per cent)	35.77 ± 7.98	35.51 ± 7.84	.26433	1.11761	.20405	1.295	.205	NS
Body water(per cent)	52.09 ± 2.48	52.29 ± 2.57	-.1967	1.1090	.2025	-.971	.339	NS
Visceral fat(Kg)	9.39 ± 1.81	9.50 ± 1.86	-.11467	.64024	.11689	-.981	.335	NS

* Significant at 0.05 level NS – Not Significant. S – Significant

Above table XXIII depicted that the Control group was found to be ineffective (p=.784) in reducing weight, as there was a weight gain of 0.18±3.49kg (0.24 per cent) with a t value of -.277. With the exception of waist hip ratio (p=0.004), none of the biometric measurements decreased among participants in the Control group. Participants using only medicine did not have a significant reduction in weight, BMI, waist, hip, body fat, body water, or visceral fat levels (p>0.05). However, as shown in Table XX, all biometric indicators were comparable at the baseline. In the control group, there was no significant decrease in any of the biometric variables and it might be due to their usage of medications even before they have recruited for the study. The Triceps Skinfold thickness showed an

increase of 0.03±1.17cm among the Control group. Twenty six per cent of the participants in the study group were on metformin, 16.6 per cent were started on Oral Contraceptive pills and 20 per cent were on nutritional supplements such as chiroinositol. Remaining 10 per cent were on Spironolactone .All were considered for all the basic anthropometric, biochemical and clinical testing at the time of visit and also after 90 days of medical management.

e) Comparison of Anthropometric parameters between the Intervention groups following interventions

Analysis of anthropometric data post interventions in the intervention groups. The following tables show the efficiency of the nutrition interventions in terms of anthropometric measurements between the groups after nutrition intervention. The comparison of anthropometric measurements between Experimental group I and Experimental group II after interventions is shown in Table XXIV.

Table XXIV Comparison of Anthropometric measurements between Experimental group I and Experimental group II following interventions

Variables	Experimental I (N=32)	(Experimental II (N=31)	t value	Sig. (2-tailed)	S/NS
	Mean ± SD	Mean ± SD			
Weight	70.05 ± 10.43	73.73 ± 16.21	-1.07	0.29	NS
BMI(Kg/m^2)	28.05 ± 4.27	29.82 ± 5.73	-1.39	0.17	NS
Total skin fold thickness (mm)	26.49 ± 5.82	27.00 ± 7.35	-0.31	0.76	NS
Waist Circumference(In)	35.18 ± 3.62	37.84 ± 4.75	-2.50	0.02*	S
Hip Circumference(In)	40.82 ± 3.45	43.22 ± 4.19	-2.50	0.02*	S
Waist Hip Ratio	0.85±0.05	0.86±0.05	-1.08	0.02*	S
Body fat(per cent)	34.32 ± 7.93	38.54 ± 6.79	-2.28	0.03*	S
Body water(per cent)	52.56 ± 2.40	51.63 ± 3.05	1.34	0.18	NS
Visceral fat(Kg)	8.83 ± 1.96	9.44 ± 2.60	-0.82	0.41	NS

Table XXIV shows Comparison of Anthropometric parameters between Experimental group I and Experimental group II following interventions. An independent sample t test was used to compare the anthropometric measurements across the groups, as shown in Table XXIV. Between Experimental group I and II, there was no discernible difference in weight, total skin fold thickness, body water, or visceral fat ($p>0.05$). Between

Experimental groups I and II, there was a significant difference in body fat, waist circumference, hip circumference, and waist hip ratio ($p < 0.05$).

Table XXV represented the comparison of anthropometric measurements between Experimental group I and Control group following interventions

Table XXV Comparison of Anthropometric measurements following interventions between Experimental group I and Control group

Variables	Experimental I (N=32)	Control (N=30)	t value	Sig. (2-tailed)	S/NS
	Mean ± SD	Mean ± SD			
Weight(Kg)	70.05 ± 10.43	74.91 ± 11.32	-1.76S	0.08	NS
BMI(Kg/m^2)	28.05 ± 4.27	30.53 ± 4.07	-2.34	0.02*	S
Total skin fold thickness(mm)	26.49 ± 5.82	27.80 ± 6.99	-0.80	0.43	NS
Waist Circumference(In)	35.18 ± 3.62	36.21 ± 4.34	-1.01	0.31	NS
Hip Circumference(In)	40.82 ± 3.45	41.99 ± 4.18	-1.21	0.23	NS
Waist Hip Ratio	0.85±0.05	0.87±0.04	-1.28	0.21	NS
Body fat (per cent)	34.32 ± 7.93	35.51 ± 7.84	-0.60	0.55	NS
Body water (per cent)	52.56 ± 2.40	52.29 ± 2.57	0.43	0.67	NS
Visceral fat(Kg)	8.83 ± 1.96	9.50 ± 1.86	-0.081	0.09	NS

From the above Table XV, it is clearly evident that any of the anthropometric measurements such as weight ,Total skin fold thickness , waist circumference, hip circumference, waist hip ratio , body fat , body water and visceral fat had not shown significant difference between Experimental group I and Control group following the nutrition interventions. BMI has shown difference ($p=0.022$) between Experimental group I and Control group.

Table XVI depicted the comparison of anthropometric measurements between the the Experimental group II and control group.

Table XXVI Comparison of Anthropometric measurements between Experimental group II and Control group following interventions

Variables	(Experimental II (N=31)	Control (N=30)	t value	Sig. (2-tailed)	S/NS
	Mean ± SD	Mean ± SD			
Weight	73.73 ± 16.21	74.91 ± 11.32	-0.33	0.74	NS
BMI(Kg/m^2)	29.82 ± 5.73	30.53 ± 4.07	-0.56	0.58	NS
Total skin fold thickness(mm)	27.00 ± 7.35	27.80 ± 6.99	-0.43	0.67	NS
Waist Circumference(In)	37.84 ± 4.75	36.21 ± 4.34	1.39	0.17	NS
Hip Circumference(In)	43.22 ± 4.19	41.99 ± 4.18	1.15	0.25	NS
Waist Hip Ratio	0.86±0.05	0.87±0.04	-0.11	0.92	NS
Body fat(per cent)	38.54 ± 6.79	35.51 ± 7.84	1.61	0.11	NS
Body water (per cent)	51.63 ± 3.05	52.29 ± 2.57	-0.91	0.37	NS
Visceral fat(Kg)	9.44 ± 2.60	9.50 ± 1.86	-0.51	0.61	NS

The comparison of anthropometric measurements between the Experimental group II and control group is shown in Table XXVI. Weight, BMI, TSF, WC, HC, WHR, body fat, body water, and visceral fat were the only anthropometric factors that did not significantly differ across the groups ($p>0.05$). After 90 days of dietary intervention, there was no discernible difference in weight between the Experimental I and Experimental II groups ($p=0.290$) or between the Experimental I and Control group ($p=0.0838$).

f) Impact of Nutrition Interventions on Anthropometric measurements of the Participants within and between the groups

One-way ANOVA was performed to analyse the effectiveness of Nutrition intervention strategies. Table XXVII compared the change in anthropometric measurements between the Experimental I group, Experimental II group and Control group. The mean difference in anthropometric measures were compared using Analysis of variance. It showed that all the anthropometric variables shown the significant reduction except body water and visceral fat

Table XXVII Impact of Nutrition interventions and Medication on Anthropometric measurements of the participants

Description	Variables	N	Mean±SD	F	Sig. (2-tailed	S/NS
Weight difference	Experimental I	32	4.75±2.65	24.215	0.000*	S
	Experimental II	31	1.92±2.11			
	Control	30	-.18±3.49			
	Total	93	2.22±3.43			
BMI difference	Experimental I	32	1.88±1.07	20.502	0.000*	S
	Experimental II	31	1.00±1.27			
	Control	30	-.10±1.30			
	Total	93	0.95±1.45			
Waist difference	Experimental I	32	1.55±1.21	12.769	0.000*	S
	Experimental II	31	0.13±1.52			
	Control	30	0.010±1.28			
	Total	93	0.58±1.15			
Hip difference	Experimental I	32	1.08±1.08	8.294	0.000*	S
	Experimental II	31	0.17±1.51			
	Control	30	-.18±1.15			
	Total	93	0.37±1.36			
Body fat difference	Experimental I	32	1.54±1.18	11.6	0.000*	S
	Experimental II	31	0.719±0.83			
	Control	30	0.26±1.11			
	Total	93	0.85±1.17			
Body water change	Experimental I	32	-.01±1.74	.139	0.870	NS
	Experimental II	31	-.09±1.17			
	Control	30	-.20±1.10			
	Total	93	-.10±1.37			
Visceral fat change	Experimental I	32	0.47±0.72	2.605	.079	NS
	Experimental II	31	.45±1.1.71			
	Control	30	-.12±0.64			
	Total	93	0.27±1.16			

* Significant at 0.05 level NS – Not Significant. S – Significant

Table XXVII and XXVII(a) indicated the one way ANOVA results**.** One way ANOVA was carried out between the study groups changes, after analysing all the pre-test values which were compared before the Nutrition Interventions. The impact of dietary supplementation with Nutrition education and allopathic medication (Control) were compared between the participants of the study groups. The weight difference, BMI

difference, waist circumference difference were significant in Analysis of Variance .Following the interventions, the groups' hip circumference (F=8.30, P=0.000) and body fat per cent (F2,90=11.60, P=0.000) also significantly changed. The participants in the study groups did not significantly vary in the change in the mean values of body water (p=0.87) and visceral fat (p= .079).

g) Comparison of Anthropometric parameters among the study groups by post hoc test to determine the efficacy of the Nutrition interventions

Table XXVIII Clearly summarised the ANOVA results by considering the individual differences between the study groups by post hoc comparisons using the Tukey HSD and Dunnet ”T3 .

Table XXVIII Comparison of efficacy of nutrition interventions in terms of Anthropometric parameters

Dependent variable	(I)Treatment	(J)Treatment	Mean difference	Sig. (2-tailed)	S/NS	
Weight difference	Experimental I	Experimental II	2.8274	.000*	S	
	Experimental I	Control	4.9266	.000*	S	
	Experimental II	Control	2.099	0.012*	S	
BMI difference	Experimental I	Experimental II	0.877	0.015*	S	
	Experimental I	Control	1.981	0.000*	S	
	Experimental II	Control	-1.104	0.002*	S	
Waist Difference	Experimental I	Experimental II	1.418	0.000*	S	
	Experimental I	Control	1.537	0.000*	S	
	Experimental II	Control	0.119	0.936	NS	
Hip circumference	Experimental I	Experimental II	0.917	0.014*	S	
	Experimental I	Control	1.261	0.000*	S	
	Experimental II	Control	0.344	0.540	NS	
Body fat Per centage	Experimental I	Experimental II	0.818	0.008*	S	
	Experimental I	Control	1.273	0.000*	S	
	Experimental II	Control	0.455	0.217	NS	
Body water	Experimental I	Experimental II	0.0746	0.975	NS	
	Experimental I	Control	0.184	0.859	NS	
	Experimental II	Control	.109	0.948	NS	
Visceral fat	Experimental I	Experimental II	0.010	0.999	NS	
	Experimental I	Control	0.580	0.116	NS	
	Experimental II	Control	0.569	0.129	NS	
Total Skinfold Thickness	Experimental I	Experimental II	0.9194	0.106	NS	
	Experimental I	Control	1.526	0.004*	S	
	Experimental II	Control	0.607	0.070	NS	
Waist Hip Ratio	Experimental I	Experimental II	1.244	0.685	NS	
	Experimental I	Control	1.236	0.690	NS	
	Experimental II	Control	-.0083	0.323	NS	

* Significant at 0.05 level NS – Not Significant. S – Significant

The post hoc test's results were summarised in Table XXVIII. Since the Levene statistic for “weight, BMI, waist, hip, body fat per cent, body water, and visceral fat was insignificant (p>0.05), equal variances were assumed. To check the individual differences

between groups' post hoc comparisons using Tukey HSD was performed. For Total skin fold thickness and for Waist Hip Ratio, the Levene statistic was significant (P<0.05) and the post hoc comparisons were assessed using Dunnet"T3.

The test indicated that the mean difference in weight of Experimental group I(M±SD 4.75±2.65) and Experimental group II I(M±SD1.92±2.11) and control group was(M±SD-.18±3.49) .The difference in means of weight between the Experimental group I and Experimental group II group was (MD=2.8274)(p=0.000),. Experimental group I and control was (MD=4.9)(p=0.000) Experimental group II and control was (MD=2.099)(p=0.012).The mean difference in weight between and among the groups were significant .The highest difference was seen between Experimental group I and Control. The Mean difference in BMI of the participants of study groups were (M=1.88 SD=1.07) for Experimental group I, (M=1.003, SD=1.270) for Experimental II, and (M=-.100, SD=1.304) for Control groups. The mean difference between the Experimental I and II was 0.87 ,Experimental I and control was1.98 and Experimental II and Control was -1.10 respectively .The mean difference all the three groups were significant at 0.05 level. The highest difference was in the Experimental I and Control group

The mean difference in waist circumference of the participants in Experimental I after the Nutrition Intervention (M=1.54, SD=1.205) differed significantly from Experimental II (M=0.129, SD=1.521). No significant differences was observed between Experimental II and Control group (M=0.010, SD=1.279). The mean difference in means of waist circumference between the groups was significant for Experimental group I and II (MD=1.41)(p=0.00),and for Experimental I and control(MD=1,53)(P-0.000), but was insignificant between Experimental II and Control (MD=0.12)(p=0.93).Highest was between Experimental I and Control Significant difference in Hip circumference (M=1.084, SD=1.088) between Experimental I and Experimental II (M=0.167, SD=1.510) was observed, whereas the difference was not significant between Experimental II and Control (M=-.176, SD=1.558) .The mean difference was significant (MD=0.92)(p=0.014) for Experimental I and II , and for Experimental I and control (MD=1.26)(p=0.000).The mean difference for Experimental II and Control was insignificant (p=0.54)

The mean difference in body fat per cent Nutrition supplementation and education in Experimental I (M=1.53, SD=1.179) differed significantly from Experimental II (M=0.719, SD=0.834) and Control group (M=0.264, SD=1.117).No significant difference was seen between Experimental II and Control (p>0.05) .The mean difference was significant between Experimental I and II (MD=0.82)and between Experimental I and Control (MD=1.27) at a significance level p<0.05 No significant difference was noted between any of the nutrition intervention groups in terms of mean Waist Hip ratio, , Visceral fat and Body water (p>0.05). For Triceps Skin fold thickness, the mean difference was significant between Experimental group I and control (MD=1.5) (P=0.004).The ANOVA results proved Experimental I has significantly reduced PCOS symptoms compared to the Experimental II and Control group.

Table XXVIII(a): Comparison of Anthropometric parameters between the groups at baseline and following intervention

Variable	Nutrition Intervention	nterve (N=32)	Nutrition Education(N=31)	Control (N=30)	P*
Weight	Baseline	74.77 ± 10.50	75.65 ± 16.27	74.73 ± 12.11	0.953
	After 3m	70.05 ± 10.43	73.73 ± 16.21	74.91 ± 11.32	0.304
	Changes	-4.7188± 2.6441	-1.9226± 2.1175	0.18±3.49	0.000
	P**	<.0001	<.0001	0.78	
BMI	Baseline	29.95 ± 4.35	30.82 ± 5.82	30.43 ± 4.18	0.776
	After 3m	28.05 ± 4.27	29.82 ± 5.73	30.53 ± 4.07	0.110
	Changes	-1.9031±1.0669	-1.0035±1.2706	0.10±1.30	0.000
	P**	<.0001	0.0001	0.68	
TSF	Baseline	27.98 ± 6.69	27.55 ± 7.62	27.77 ± 7.25	0.971
	After 3m	26.49 ± 5.82	27.00 ± 7.35	27.80 ± 6.99	0.745
	Changes	-1.4969± 2.2544	-0.5452±0.8477	0.03±1.17	0.01
	P**	0.0007	0.0012	0.89	
WC	Baseline	36.73 ± 3.12	37.97 ± 4.10	36.22 ± 4.90	0.231
	After 3m	35.18 ± 3.62	37.84 ± 4.75	36.21 ± 4.34	0.049
	Changes	-1.5469±1.2051	-0.129±1.5219	-0.01±1.28	0.000
	P**	<.0001	0.6403	0.97	
HC	Baseline	41.90 ± 3.47	43.39 ± 4.04	41.81 ± 4.58	0.231
	After 3m	40.82 3.45	43.22 ± 4.19	41.99 ± 4.18	0.059
	Changes	-1.0844±1.089	-0.1677±1.5105	0.0180±1.16	0.000
	P**	<.0001	0.541	0.41	
BODY FAT	Baseline	35.85 ± 7.68	39.26 ± 6.86	35.77 ± 7.98	0.120
	After 3m	34.32 ± 7.93	38.54 ± 6.79	35.51 ± 7.84	0.000
	Changes	-1.5375±1.179	-0.7194±0.834	-0.26±1.12	
	P**	<.0001	<.0001	0.21	0.000
BODY WATER	Baseline	52.55 ± 2.53	51.55 ± 3.35	52.09 ± 2.48	0.372
	After 3m	52.56 ± 2.40	51.63 ± 3.05	52.29 ± 2.57	0.376
	Changes	0.0125±1.743	0.0871±1.1727	0.20±1.11	0.870
	P**	0.97	0.6822	0.34	
VISCERAL FAT	Baseline	9.30 ± 1.73	9.60 ± 2.66	9.39 ± 1.81	0.779
	After 3m	8.83 ± 1.96	9.44 ± 2.60	9.50 ± 1.86	0.357
	Changes	-0.4687±0.7213	-0.1645 ±0.243	0.11±0.64	.079
	P**	0.001	0.0007	0.33	

At base line there was no significant difference in body fat , waist and hip circumference in these groups as shown in table XXVII(a) with a p value >0.05

Since BMI, Body weight , Waist Circumference change , body fat per centage were not normally distributed Kruskal wallies test was also used for comparing the differences in change of BMI , Body weight , Waist Circumference , Body fat across the 3 groups. It was statistically significant with p value of weight change =0.0001, BMI Change =0.001, Waist Circumference change =0.001 and Body fat change =0.009

Table XXVIII (b) Impact of Nutrition interventions and Medication on Anthropometric measurements of the participants

Null hypothesis	Test	Significance
The distribution of weight change is same across categories of Intervention type	Independent sample Kruskal Wallis test	0.0001
The distribution of BMI change is same across categories of Intervention type	Independent sample Kruskal Wallis test	0.0001
The distribution of Waist Circumference change is same across categories of Intervention type	Independent sample Kruskal Wallis	0.0001
The distribution of Body fat change is same across categories of Intervention type	Independent sample Kruskal Wallis	0.009

B) Impact of the Nutrition interventions on biochemical profile of the participants

Effectiveness of the nutrition interventions on the biochemical profile of the participants in each group is discussed below

a) Mean biochemical profile of the participants

The mean biochemical profile of the participants at base line is represented in Table XXI

Table XXIX Initial Biochemical Profile of the Participants in the study groups

Variable	Experimental I (N=32)	Experimental II (N=31)		Control(N=30)	
	Mean ± SD	Mean ± SD	Pr > |t|	Mean ± SD	Pr > |t|
Haemoglobin(g/dl)	12.65 ± 1.14	12.19 ± 1.38	0.1543	12.63 ± 1.27	0.9395
Random blood sugar (mg/dl)	103.10 ± 33.65	96.29 ± 13.15	0.2934	104.60 ± 16.73	0.8277
Cholesterol (mg/dl)	206.90 ± 37.48	195.20 ± 39.72	0.2331	197.90 ± 40.86	0.3689
Triglycerides (mg/dl)	126.10 ± 65.10	139.20 ± 92.13	0.5139	133.60 ± 77.64	0.6795
High Density Lipoprotein (mg/dl)	47.47 ± 14.47	43.25 ± 8.32	0.1612	44.21 ± 7.51	0.2672
Low Density Lipoprotein (mg/dl)	134.10 ± 34.46	126.40 ± 30.33	0.3465	128.70 ± 30.06	0.5126
Cholesterol /HDL Ratio	4.83 ± 1.28	4.53 ± 1.36	0.3762	4.57 ± 1.13	0.4049
VLDL (mg/dl)	24.06 ± 14.02	27.62 ± 17.52	0.3768	26.72 ± 15.56	0.4822
Testosterone (ng/dl)	0.59 ± 0.40	0.44 ± 0.29	0.1023	0.52 ± 0.27	0.4571

Table XXIX clearly indicated that there was no significant difference in any of the biochemical Profile such as Random blood sugar, Cholesterol , triglycerides , high density lipoprotein, low density lipoprotein , cholesterol to HDL ratio, Very Low density lipoprotein and Testosterone (P>0.05) between the groups at baseline .

b) Effect of Nutrition Intervention on biochemical profile of the participants in Experimental group I

Table XXX revealed the effect of Nutrition supplementations and education on the biochemical profile of the Experimental group I

Table XXX. Effect of Nutrition Intervention on Biochemical profile of the participants in Experimental group I

Biochemical values	Mean +SD Before	Mean +SD After	Mean	Std. Deviation	Std. Error Mean	t	Sig. (2-tailed	S/NS
Haemoglobin(g/dl)	12.65 ± 1.14	12.80 ± 0.97	-.153	.997	.176	-.869	.392	NS
Random blood sugar (mg/dl)	103.10 ± 33.65	102.80 ± 28.23	.321	20.48	3.62	.089	.930	NS
Cholesterol (mg/dl)	206.90 ± 37.48	195.60 ± 23.67	11.28	28.44	5.03	2.24	.032*	S
Triglycerides (mg/dl)	126.10 ± 65.10	108.80 ± 39.81	17.218	46.87	8.29	2.08	.046*	S
High Density Lipoprotein (mg/dl)	47.47 ± 14.47	48.86 ± 10.72	-3.22	5.29	.936	-3.44	.002*	S
Low density Lipoprotein (mg/dl)	134.10 ± 34.46	128.70 ± 25.51	8.53	20.57	3.64	2.35	.026*	S
Cholesterol /HDL Ratio	4.83 ± 1.28	4.27 ± 0.99	.556	.906	.161	3.47	.002*	S
VLDL (mg/dl)	24.06 ± 14.02	21.18 ± 9.86	3.25	12.02	2.13	1.53	.136	NS
Testosterone (ng/dl)	0.59 ± 0.40	0.44 ± 0.24	.145	.239	.042	3.44	.002*	S

* Significant at 0.05 level NS – Not Significant. S – Significant

Table XXX revealed that after three months of Nutrition Intervention there was a significant reduction in serum level of cholesterol (M=11.28,SD=28.44) (p=0.032), Triglycerides (M=6.61,SD= 23.40)(p=0.046),), Low density Lipoprotein(M= 8.53, SD=20.57) (p=0.026) Cholesterol to HDL ratio (p=0.002)and testosterone level (p=0.002). HDL level had shown a significant increase of (M=2.46, SD=4.48) (p=0.002There was no significant difference (p>0.05) in values of haemoglobin, random blood sugar and VLDL before and after nutrition intervention.

c) Effectiveness of the Nutrition Education on biochemical profile of the participants of Experimental group II

Table XXXI explained the effectiveness of Nutrition Education on biochemical profile of the participants

Table XXXI Effectiveness of Nutrition Education on Biochemical profile of the participants in the Experimental group II

Biochemical Values	Mean +SD Before	Mean +SD After	Mean	Std. Deviation	Std. Error Mean	t value	Sig. (2-tailed	S/NS
Haemoglobin (g/dl)	12.19 ± 1.38	12.28 ± 1.00	-.087	.694	.125	-.699	.490	NS
Random blood sugar (mg/dl)	96.29 ± 13.15	95.52 ± 9.00	.774	7.13	1.280	.605	.550	NS
Cholesterol (mg/dl)	195.20 ± 39.72	193.40 ± 38.52	1.78	16.17	2.904	.611	.546	NS
Triglycerides (mg/dl)	139.20 ± 92.13	132.60 ± 76.58	6.61	23.41	4.204	1.57	.126	NS
High Density Lipoprotein(mg/dl)	43.25 ± 8.32	45.72 ± 6.07	-2.46	4.48	.804	-3.06	.005*	S
Low density Lipoprotein (mg/dl)	126.40 ± 30.33	121.40 ± 30.56	5.00	14.38	2.582	1.94	.062	NS
Cholesterol /HDL Ratio	4.53 ± 1.36	4.28 ± 1.07	.249	.949	.1704	1.46	.155	NS
VLDL)mg/dl)	27.62 ± 17.52	23.79 ± 15.77	2.52	10.79	1.938	1.30	.203	NS
Testosterone (ng/dl)	0.44 ± 0.29	0.44 ± 0.29	.00226	.06464	.01161	.195	.847	NS

* Significant at 0.05 level NS – Not Significant. S – Significant

Table XXXI revealed that, after three months of nutrition education, there was a slight significant increase in serum HDL levels with the mean values of 5.0mg (p=0.005). There was no significant difference (p>0.05) in the values of haemoglobin, random blood sugar, Triglycerides, total cholesterol, LDL, Cholesterol to HDL ratio and VLDL levels comparing before and after the intervention .There was a slight difference in the pre and post testosterone values with a mean difference of 0.002ng.

d) Effect of the Medication on Biochemical profile of the participants in the Control group

Table XXXII depicted the effect of Medication intervention on the biochemical profile of the participants in the control group.

Table XXXII Effect of Medication on biochemical profile of the participants

Biochemical Values	Mean +SD Before	Mean +SD After	Mean	Std. Deviation	Std. Error Mean	t	Sig. (2-tailed	S/NS
Haemoglobin (g/dl)	12.63 ± 1.27	12.54 ± 0.83	.0833	.9079	.1658	.503	.619	NS
Random blood sugar (mg/dl)	104.60 ± 16.73	100.70 ± 11.79	3.83	12.26	2.238	1.713	.097	NS
Cholesterol (mg/dl)	197.90 ± 40.86	207.20 ± 41.21	-9.30	24.83	4.534	-2.051	.049*	S
Triglycerides (mg/dl)	133.60 ± 77.64	141.20 ± 78.04	-7.57	45.38	8.285	-.913	.369	NS
High Density Lipoprotein (mg/dl)	44.21 ± 7.51	44.86 ± 7.42	-.653	4.50	.822	-.795	.433	NS
Low density Lipoprotein(mg/dl)	128.70 ± 30.06	132.10 ± 28.76	-3.367	15.46	2.823	-1.193	.243	NS
Cholesterol /HDL Ratio	4.57 ± 1.13	4.69 ± 1.15	-.122	.889	.162	-.754	.457	NS
VLDL (mg/dl)	26.72 ± 15.56	26.77 ± 16.24	-.050	9.64	1.760	-.028	.978	NS
Testosterone (ng/dl)	0.52 ± 0.27	0.54 ± 0.26	-.0147	.117	.0213	-.688	.497	NS

* Significant at 0.05 level NS – Not Significant. S – Significant

Table XXXII explained that after three months of medication intervention, meagre decrease in serum cholesterol level was observed in Control group with a mean value of 9.30±24.83mg (p=0.049) .In Control group no significant difference was observed after the intervention in terms of other biochemical profiles of “TG, HDL, LDL, “and Cholesterol to HDL ratio, VLDL and Testosterone levels (p>0.05).

e) Comparison of biochemical profile between the Intervention groups following interventions

Table XXXIII described the effect of the nutrition interventions between study groups in terms of biochemical parameters after the intervention using Independent sample t test.

Table XXXIII Comparison of biochemical Profile between the Participants of the Experimental group I and Experimental group II

Variable	Expt I (N=32)	Expt II (N=31)	T	P value
Haemoglobin (g/dl)	12.80 ± 0.97	12.28 ± 1.00	2.11	0.039*
Random blood sugar (mg/dl)	102.80 ± 28.23	95.52 ± 9.00	1.39	0.17
Cholesterol (mg/dl)	195.60 ± 23.67	193.40 ± 38.52	0.27	0.79
Triglycerides (mg/dl)	108.80 ± 39.81	132.60 ± 76.58	-1.54	0.13
High Density Lipoprotein (mg/dl)	48.86 ± 10.72	45.72 ± 6.07	1.43	0.16
Low density Lipoprotein(mg/dl)	128.70 ± 25.51	121.40 ± 30.56	1.04	0.30
Cholesterol /HDL Ratio	4.27 ± 0.99	4.28 ± 1.07	-.043	0.97
VLDL (mg/dl)	21.18 ± 9.86	23.79 ± 15.77	-.89	0.44
Testosterone (ng/dl)	0.44 ± 0.24	0.44 ± 0.29	.03	0.98

* Signficant at 0.05 level

Table XXXIII clearly indicated that after the intervention there was a significant difference in the mean values of haemoglobin (p=0.039) between the Experimental group I and Experimental group II.Other biochemical parameters such as Random Blood sugar, Total cholesterol, TG, HDL, LDL, Cholesterol to HDL ratio, VLDL, Testosterone has not shown any significant difference between the Experimental group I and Experimental group II.

Table XXXIV explained the biochemical profile of the participants between the groups following interventions

Table XXXIV Comparison of Biochemical Profile between the Participants of the Experimental group I and Control group

Table XXXIV **Comparison of Biochemical Profile between of the Participants of the Experimental group I and Control group**

Variable	Expt I (N=32)	Control group (N=30)	T	p
Haemoglobin (g/dl)	12.80 ± 0.97	12.54 ± 0.83	1.13	0.26
Random blood sugar (mg/dl)	102.80 ± 28.23	100.70 ± 11.79	0.37	0.71
Cholesterol (mg/dl)	195.60 ± 23.67	207.20 ± 41.21	-1.34	0.19
Triglycerides (mg/dl)	108.80 ± 39.81	141.20 ± 78.04	-2.03	0.05
High Density Lipoprotein (mg/dl)	48.86 ± 10.72	44.86 ± 7.42	1.69	0.09
Low density Lipoprotein(mg/dl)	128.70 ± 25.51	132.10 ± 28.76	0.80	0.63
Cholesterol /HDL Ratio	4.27 ± 0.99	4.69 ± 1.15	0.90	0.13
VLDL (mg/dl)	21.18 ± 9.86	26.77 ± 16.24	-1.73	0.11
Testosterone (ng/dl)	0.44 ± 0.24	0.54 ± 0.26	-1.51	0.14

* Significant at 0.05 level

Table XXXIV revealed that there was no significant difference in any of the biochemical parameters between Experimental group I and Control group (P>0.05) following interventions

Table XXXV Comparison of Biochemical Profile between of the Participants of the Experimental group II and Control group

Variable	Expt II (N=31)	Control group (N=30)	T	Sig
Haemoglobin (g/dl)	12.28 ± 1.00	12.54 ± 0.83	-1.13	0.26
Random blood sugar (mg/dl)	95.52 ± 9.00	100.70 ± 11.79	-1.95	0.06
Cholesterol (mg/dl)	193.40 ± 38.52	207.20 ± 41.21	-1.35	0.18
Triglycerides (mg/dl)	132.60 ± 76.58	141.20 ± 78.04	-.43	0.67
High Density Lipoprotein (mg/dl)	45.72 ± 6.07	44.86 ± 7.42	0.49	0.63
Low density Lipoprotein(mg/dl)	121.40 ± 30.56	132.10 ± 28.76	-1.41	0.16
Cholesterol /HDL Ratio	4.28 ± 1.07	4.69 ± 1.15	-1.44	0.16
VLDL (mg/dl)	23.79 ± 15.77	26.77 ± 16.24	-.73	0.47
Testosterone (ng/dl)	0.44 ± 0.29	0.54 ± 0.26	-1.37	0.18

* Significant at 0.05 level

Table XXXV described the effect of the interventions in terms of biochemical parameters between study groups .None of the biochemical parameters such as "RBS, Total Cholesterol, TG, HDL, LDL, Cholesterol to HDL ratio, VLDL, Testosterone" shown significant difference between Experimental group II and Control group.

f) Impact of Nutrition interventions on the biochemical profile of the participants within and between the study groups

Impact of Nutrition interventions on the biochemical profile of the participants in the three study groups by Analysis of Variance is represented in table XXXVI

Table XXXVI Impact of Dietary Supplementation, Nutrition Education and Medication on biochemical profile of the participants in the study groups

biochemical profile	Variables	N	Mean+SD	Std. Deviation	F	Sig
Haemoglobin	Experimental I	32	-.15±0.99	.99709	.595	.554 (NS)
	Experimental II	31	-.09±0.69	.69366		
	Control	30	.08±0.91	.90785		
	Total	93	-.05±0.87	.87272		
Random blood sugar	Experimental I	32	.32±20.4	20.48255	.531	. 59 (NS)
	Experimental II	31	.77±7.1	7.12605		
	Control	30	3.83±12.26	12.25613		
	Total	93	1.61±14.41	14.41173		
Cholesterol	Experimental I	32	11.2813	28.43922	5.814	.004* (S)
	Experimental II	31	1.7742	16.16933		
	Control	30	-9.3000	24.83345		
	Total	93	1.4731	24.97024		
Triglyceride	Experimental I	32	17.2188	46.87302	2.979	.05* (S)
	Experimental II	31	6.6129	23.40894		
	Control	30	-7.5667	45.37786		
	Total	93	5.688	40.88903		
High density lipoprotein	Experimental I	32	-1.3937	13.10149	.796	.454 (NS)
	Experimental II	31	-3.9129	7.93510		
	Control	30	-1.1867	5.40075		
	Total	93	-2.1667	9.43999		
Low density lipoprotein	Experimental I	32	5.4063	25.21886	2.318	.104 (NS)
	Experimental II	31	6.4516	11.70709		
	Control	30	-2.8333	15.24757		
	Total	93	3.0968	18.69205		
Cholesterol to HDL ratio	Experimental I	32	.5563	.90592	4.262	.017 (S) *
	Experimental II	31	.2484	.94861		
	Control	30	-.1223	.88919		
	Total	93	.2347	.94699		
Very low density lipoprotein	Experimental I	32	3.2531	12.02291	.778	.462 (NS)
	Experimental II	31	2.5194	10.78865		
	Control	30	-.0500	9.64035		
	Total	93	1.9430	10.86100		
Testosterone	Experimental I	32	.1450	.23873	9.509	.000* (S)
	Experimental II	31	.0023	.06464		
	Control	30	-.0147	.11676		
	Total	93	.0459	.17355		

* Significant at 0.05 level NS – Not Significant. S – Significant

As shown in Table XXXVI, there was a significant mean decrease in many biochemical parameters between the study groups. These included testosterone (p=0.000), triglycerides (p=0.05), cholesterol to HDL ratio (p=0.017), and triglyceride to total cholesterol ratio (p=0.004) values of the study participants. The data revealed that all the biochemical variables shown considerable significant reduction in the profile. The impact of Nutrition interventions and allopathic medications were compared between the study groups . According to the ANOVA results, there was a difference in cholesterol (F2,90=5.814, P=0.004) and triglycerides (F2,90=2.97, P=0.05)..Difference in cholesterol to HDL ratio (F*2,90*=4.26,p=0.017) and difference in Testosterone levels (F*2,90*9.509, p=0.000) was highly significant. Tukeys test was carried out to identify the group which caused the significant difference. Test of homogeneity of variance was done using Levene Statistic, the homogeneity of the groups indicated that the groups were compared.

g) Comparison of biochemical Profile among the participants of the study groups for determining the efficacy of the nutrition interventions.

Table XXXVII exhibited the clear explanation on ANOVA results with individual differences between the study groups by post hoc comparisons using the Tukey HSD and Dunnet ”T3 .Since the Levene statistic was significant (P<0.05) for LDL cholesterol and Testosterone , the post hoc comparisons were analysed using Dunnet ”T3.The Levene statistic was insignificant(p>0.05) for Haemoglobin, Random blood sugar, Total cholesterol, Triglyceride HDL , Cholesterol to HDL ratio , VLDL and equal variances were assumed . To check the individual differences between groups post hoc comparisons using Tukey HSD was performed

Table XXXVII Statistical Comparison of biochemical Profile among the participants in the study groups

Dependent variable difference in	(I)Treatment	(J)Treatment	Mean difference	Sig. (2-tailed)	NS/S
Haemoglobin	Experimental I	Experimental II	-.06603	.952	NS
	Experimental I	Control	-.23646	.540	S
	Experimental II	Control	-.17043	.729	NS
Random blood sugar	Experimental I	Experimental II	-.45232	.992	NS
	Experimental I	Control	-3.51146	.608	NS
	Experimental II	Control	-3.05914	.689	NS
Cholesterol	Experimental I	Experimental II	9.507	0.256	NS

Dependent variable difference in	(I)Treatment	(J)Treatment	Mean difference	Sig. (2-tailed)	NS/S
	Experimental I	Control	20.581	0.003	S
	Experimental II	Control	11.074	0.169	NS
Triglyceride	Experimental I	Experimental II	10.605	0.547	NS
	Experimental I	Control	24.785	0.044*	S
	Experimental II	Control	14.17	0.354	NS
High density lipoprotein	Experimental I	Experimental II	2.519	0.543	NS
	Experimental I	Control	-.2079	0.996	NS
	Experimental II	Control	-2.726	0.501	NS
Low density lipoprotein	Experimental I	Experimental II	-1.045	0.995	NS
	Experimental I	Control	8.239	0.322	NS
	Experimental II	Control	9.284	0.030*	S
Cholesterol to HDL ratio	Experimental I	Experimental II	0.0378	0.380	NS
	Experimental I	Control	0.6785	0.012*	S
	Experimental II	Control	0.3707	0.259	NS
VLDL	Experimental I	Experimental II	0.733	0.961	NS
	Experimental I	Control	3.303	0.460	NS
	Experimental II	Control	2.569	0.628	NS
Testosterone	Experimental I	Experimental II	0.142	0.002	S
	Experimental I	Control	0.159	0.004*	S
	Experimental II	Control	0.016	0.864	NS

* Significant at 0.05 level NS – Not Significant. S – Significant

According to Table XXXVII, The difference in cholesterol level was insignificant between Experimental group I and II (p=0.256).The mean cholesterol difference in the control group was remarkably lower when compared to Experimental group I (P=0.003). At the 0.05 threshold, the mean difference was significant. Additionally, there was no discernible difference between the Experimental II and Control groups. Although there was a significant difference in the TG values between Experimental I (M=17.218,SD=46.873) and Control (M=-7.56,SD=45.37) and Experimental II (M=6.612,SD=23.408), there was no significant difference between the two. Additionally, there was no discernible distinction between Experimental II and Control. While there was no significant difference between Experimental I and Experimental II (M= 0.248,SD=0.948), there was a significant difference

between Experimental I and Control (M= -.1233, SD =0.948) based on the cholesterol to HDL ratio (M= 0.556,SD=0.905). Regarding testosterone alterations, mean differences were (M=0.145, SD 0.238) in the Experimental group I,(M=0.0023, SD 0.0646) in the Experimental group II (M=-0.0147, SD 0.1667)in the control group. There was a significant difference between the Experimental group I and II(p=0.002)and also between Experimental group I AND Control group (p=0.000) .But there was none (p=0.864) between the Experimental II and Control groups. According to the ANOVA findings, Experimental group I significantly reduced the mean value of biochemical parameters in comparison to Experimental group II and the Control group.

C) PCOS Symptom Assessment using COPE

The symptoms of PCOS was assessed individually using relevant tools. The Effect of nutrition interventions on clinical profile such as Hirsutism and Acne level are represented in Table XXXVIII.

Table XXXVIII Effect of Nutrition intervention on Hirsutism and Acne levels of the participants in the study groups

Intervention group	Hirsutism Score		MD+SD	T value	P	Acne Score		MD+SD	t	P
	Mean +SD before	Mean +SD after				Mean +SD before	Mean +SD after			
Experimental group I	4.16 ± 4.06	3.69 ± 2.93	-0.47 ± 3.39	0.78	0.44	5.31± 8.47	10.88 ± 12.21	5.56±13.45	2.34	0.03
Experimental group II	3.84 ± 3.74	4.00 ± 3.80	0.16 ± 2.08	-.431	0.67	10.10 ± 12.31	10.74 ± 13.28	0.65 ± 13.90	-.258	0.80
Control Group	5.83 ± 4.72	5.20 ± 4.38	-0.63 ± 3.41	1.02	0.32	11.97 ± 10.75	13.93 ± 14.90	1.97 ± 16.18	-.666	0.51

Table XXXVIII described that, in any of the Intervention group there were no significant difference in the scores of hirsutism after the Intervention (p>0.05). There were no appreciable differences in the Experimental group I's mean scores before and after the intervention (M=0.47, SD=3.39) (P=0.78). The mean hirsutism scores in the Experimental group II increased on average (M=0.16, SD=2.08) (p=0.67), whereas they slightly decreased in the Control group (M=0.63, SD=3.41) (p+0.32) between the groups.

The mean acne score has shown significant difference between groups (p<0.05) at base line. The mean value for acne at baseline was higher among the Control group and for Experimental group I the mean score was much lower compared to the other two

intervention groups .After the intervention the acne score has increased (M=5.56, SD=13.45) (p=0.03)in the Experimental group I significantly , which may be also due to the lower mean scores reported before the intervention. In the experimental group I there was a meagre increase of acne score (M=0.65, SD=13.9)(p=0.80) . In the Control group also there was no significant increase in acne score (M=1.97, SD=16.18) (p=0.51)

a) Comparison of Hirsutism before and after nutrition interventions and the effectiveness among the participants in the study groups

Figure 20 illustrated the t mean scores of hirsutism before and after intervention

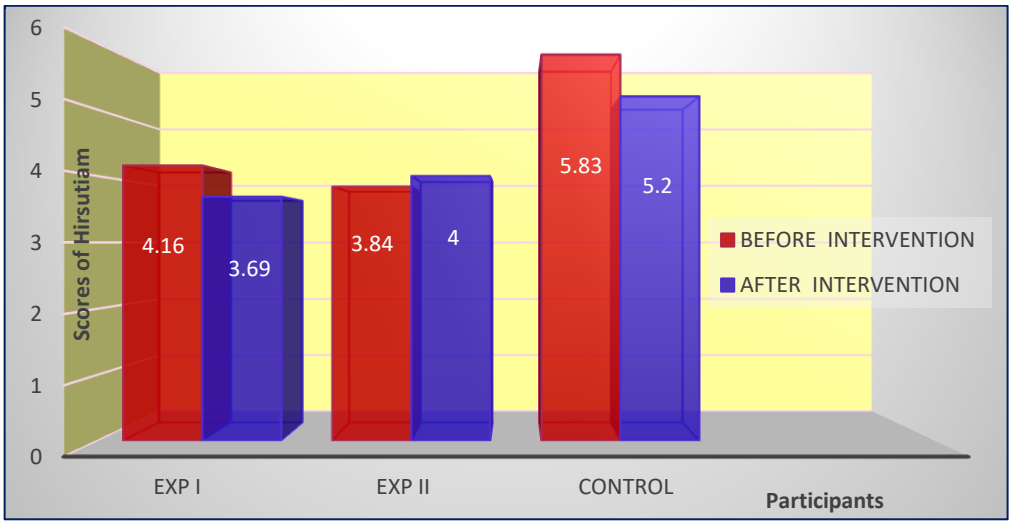

Figure 20 Mean scores of hirsutism between the Participants of the study groups

Figure 20 indicated the mean Hirsutism scores had no significant difference between the three groups (p>0.05). There was no significant difference in the reduction of hirsutism levels in any of the intervention groups .In the Experimental I group .the result of mean difference in Hirsutism levels pre and post intervention using the paired sample t test was not significant t(31)= .783, p=2.24, p=0.4399. Hirsutism, levels considerably decreased in participants in the Experimental II group t (30) =-.431, p=0.669 and Control group t (29)=-1.018, p=0.317.

b) Comparison of Clinical profile between the study groups

Effect of dietary supplementation, Nutrition education and Medication intervention on clinical symptoms of PCOS is represented clearly in Table XXXIX

Table XXXIX Comparison of Clinical profile between the study groups

Variable	Expt I (N=32) Mean ± SD	Expt II (N=31) Mean ± SD	Pr > |t|	Control(N=30) Mean ± SD	Pr > |t|
Hirsutism	3.69 ± 2.93	4.00 ±3.80	0.72	5.20 ± 4.38	0.12
Acne	10.88 ± 12.21	10.74 ± 13.28	0.97	13.93 ± 14.90	0.38

In the Table XXXIX The effectiveness of the interventions in terms of clinical symptoms in comparison to the scores after the intervention using Independent sample t test .There was no significant difference in Hirsutism ,acne the Experimental I and Experimental II groups and also between Experimental I and Control group . (p>0.05).

c) Effect of the nutrition interventions on Physical activity and Stress level of the participants

Table XL Represented the Physical activity score and Stress score of the participants before and after the interventions.

Table XL Physical activity and Stress level of the participants before and after the Nutrition Interventions

Intervention group	Physical activity Score		MD+SD	t	P	Perceived Stress Score		MD+SD	t	P
	Mean +SD before	Mean +SD after				Mean +SD before	Mean +SD after			
Experimental group I	5.69 ± 7.38	10.72 ± 9.20	5.03 ± 8.27	-3.44	0.00	20.78 ± 5.53	16.56 ± 5.93	-4.22 ± 5.68	4.20	0.00
Experimental group II	11.00 ± 19.01	13.39 ± 14.39	2.39 ± 10.89	-1.22	0.23	22.71 ± 5.05	16.35 ± 5.14	-6.35 ± 7.32	4.83	<.00
Control Group	9.20 ± 15.70	12.03 ± 16.02	2.83 ± 8.00	-1.94	0.06	20.47 ± 6.29	17.37 ± 5.82	-3.10 ± 5.54	3.06	0.00

Table XL described that, in the Experimental group I ,there was a significant mean increase of physical activity with (M=5.03 ,SD =8.27) (p=0.00).In Experimental II group, the mean increase was not significant (M=2.39, SD=10.8) (p=0..23), In control group, there was a mean increase of M=2.83, SD=8.00)(p=0.06) .Stress score were significantly reduced in all the three intervention groups (p<0.001). Stress score has reduced more in the Experimental group II (M=6.35, SD=7.32) followed by Experimental group I (M=4.22, SD=5.68) and control group (M=3.10, SD=5.54). Physical activity levels were not significantly differed among the participants in the Experimental II group and Control group.

c) Comparison of Stress level between the study groups

Comparison of stress level between the study groups is represented in Figure 21

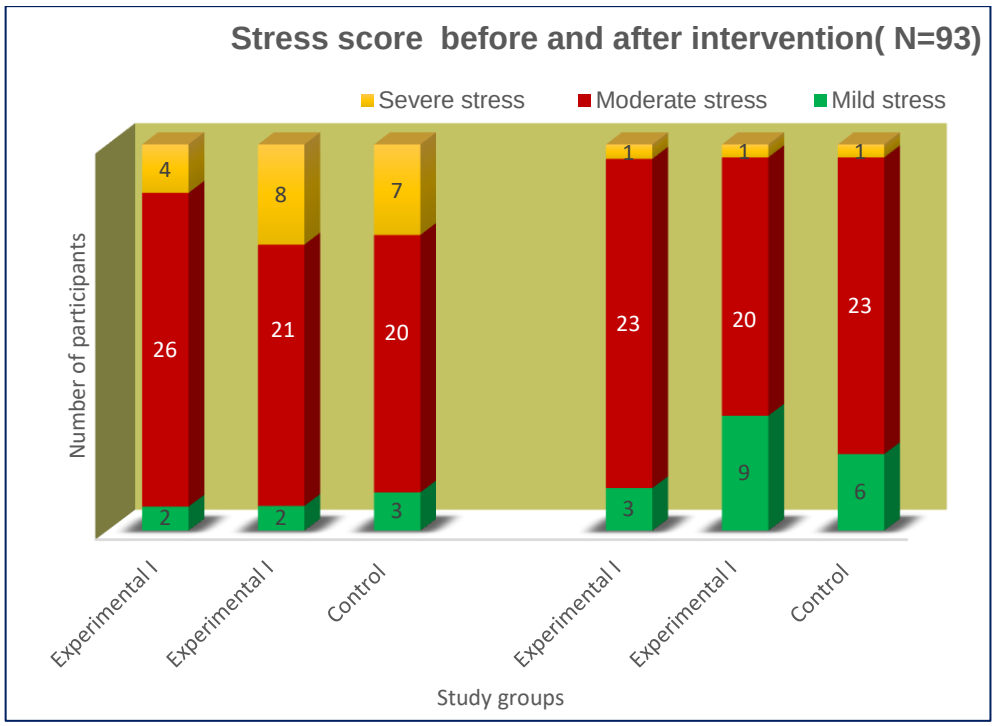

Figure 21 Stress level among the participants before and after nutrition interventions

Figure 21 revealed that the stress level score was significantly reduced with a mean decrease of (M±SD 4.2188±56), (M±SD 6.35±7.3191), (M±SD 3.1 ± 5.54) among the Experimental I and II groups, and also Control group respectively ($p<0.001$).No significant difference in stress level score noted was between the study groups following interventions. The severity of stress level has decreased in all the three nutrition interventions. In the Experimental I four participants had severe stress post intervention it was reduced to one .In the Experimental II, eight participant had severe stress and that was reduced to one. In the Control group, seven participants had severe stress and was reduced to one.

d) Impact of Nutrition intervention on Clinical Picture of Participants within and between the groups

Impact of nutrition intervention on Clinical picture of Participants between the groups is represented in XLI

Table XLI Effect of Nutrition intervention on clinical picture of the participants in the study groups

Changes in variable	Study groups	N	Mean	Std. Deviation	F	Sig
Hirsutism	Experimental I	32	.4688	3.38864	.592	.555
	Experimental II	31	-.1613	2.08322		
	Control	30	.6333	3.40874		
	Total	93	.3118	3.01077		
Acne	Experimental I	32	-5.5625	13.44508	969	.383
	Experimental II	31	-.6452	13.90096		
	Control	30	-1.9667	16.17892		
	Total	93	-2.7634	14.52165		
Perceived stress score	Experimental I	32	4.2188	5.67811	2.156	.122
	Experimental II	31	6.3548	7.31915		
	Control	30	3.1000	5.54200		
	Total	93	4.5699	6.31148		

Table XLI clearly mentioned the effect of Interventions in term of changes in the clinical picture, considering the mean score before and after intervention .There was no significant differences between the scores of Hirsutism (p=0.555), Acne (0.383), stress score (p=0.122) and Physical activity score (p=0.473) .

e) Comparison of PCOS symptoms among the participants of the study by post hoc test

Table XLII represented the comparison of PCOS symptoms between the study groups by post hoc test.

Table XLII Comparison of PCOS symptoms among the study groups by post hoc test to determine the efficacy of the nutrition interventions

Dependent variable	(I)Treatment	(J)Treatment	Mean difference	Significance
Hirsutism	Experimental I	Experimental II	0.633	0.688
	Experimental I	Control	-0.1645	0.975
	Experimental II	Control	-.794	0.563
Acne	Experimental I	Experimental II	-4.917	0.375
	Experimental I	Control	-3.595	0.595
	Experimental II	Control	-1.322	0.933
Stress	Experimental I	Experimental II	-2.136	0.366
	Experimental I	Control	1.118	0.760
	Experimental II	Control	3.255	0.109

Table XLII the post hoc comparisons were assessed using Tukeys HSD**.**The test indicated that there was no significant difference of difference in Hirsutism, Acne, Stress score of Experimental I and was not significantly differed from Experimental II and Control group. Hirsutism score was found to be increased before intervention .for Experimental II(M=0.163 ,SD=2.08),whereas the other two intervention groups it was decreased Acne levels found to be increased more among all the three groups and in the Experimental I group M=5.562, SD=13.445).All the three intervention groups showed that there was a reduction in the stress score and greatest reduction was noted in the Experimental II group (M=6.354, SD=7.319).)

D) Level of Physical activities

The mean change in the Physical activity level is depicted in Figure22. The effect of the nutrition interventions on the level of physical activity between the study groups and did not observe a significant change in the level of physical activity

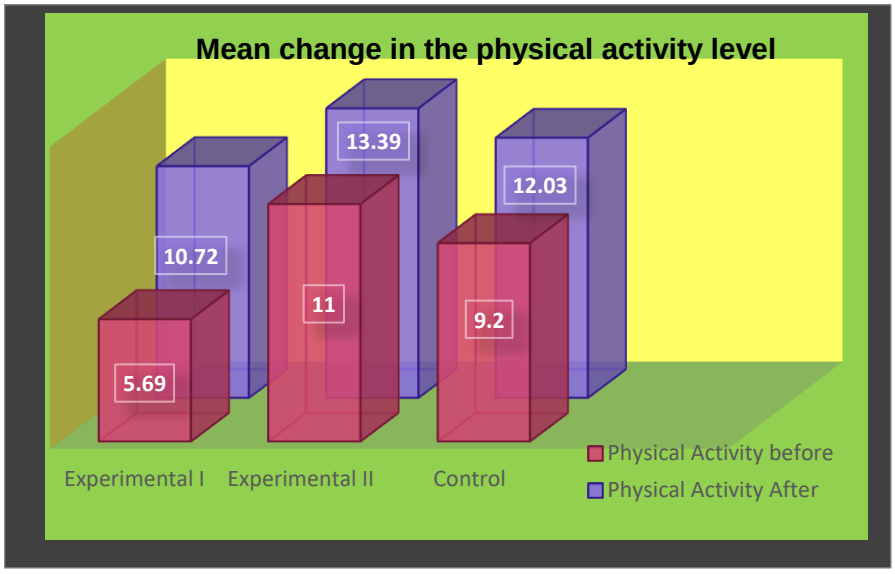

Figure 22 Mean scores of Physical activity among Participants before and after Nutrition interventions

From Figure 22 it can be noted that ,the physical activity level had a mean increase of fivefold among participants in the Experimental I group(M=5.0313±8.26, P=0.002) and indicated that the nutrition intervention group was motivated towards achieving the goals , whereas no significant increase in physical activity level was observed in Experimental II and Control group. The effectiveness of the interventions in terms of physical activity level after the intervention was assessed .There was no significant difference in physical activity level between the Experimental I and Experimental II groups and also between Experimental I and Control group. (p>0.05).

E) Regularity of Menstrual cycle in association with Nutrition Interventions

Regularity of Menstrual cycle in association with Nutrition Intervention is explained in Table XLIII

Table XLIII Odds Ratio (at 95per centCI) Regularity of Association of Intervention with Menstrual cycle

Intervention groups	Before		After		Before	After
	Regular	Irregular	Regular	Irregular		
Experimental I	6	26	24	8	OR:1.2(0.325-4.426)	OR:9.1(2.84-29.146
Experimental II	7	24	10	21		
Experimental I	6	26	26	6	OR:1.5(0.378-5.944)	OR:4.33(1.385-13.552)
Control	4	26	15	15		

Table XLIII revealed that at base line there was no significant association of menstrual cycle regularity between the study groups, those participants participated in Nutrition intervention in Experimental I group had 9.1 times higher chance of getting regular periods than those on nutrition education alone(Experimental II group)(OR : 9.1,CI 2.84-29.146), where as 4.3 times higher chance of getting regular periods compared to the Control group .(OR:4.33 CI 1.385-13.552).

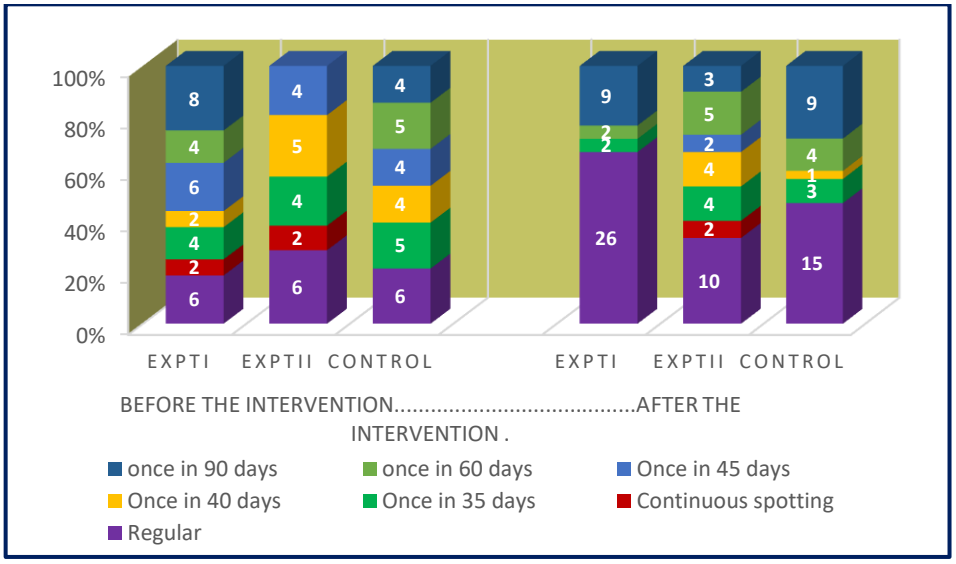

Figure 23 Regularity of Menstrual cycle of the participants before and after nutrition interventions

Level of Regularisation of menstrual cycle post intervention is explained in Figure 23.

F) Impact of individual Dietary intake

To check the type of participants as a comparable group, the three nutrition intervention groups were compared to find out the difference in mean values prior to nutrition intervention programme.

a) Mean Nutrient intake of the participants

The mean nutrient intake of the participants in the three study groups is represented in Table XLIV.

Table XLIV. Mean nutrient intake of the participants in the study groups

Nutrients	Experimental I (N=32	Experimental II (N=31)	Pr > |t|	Control (N=30)	Pr > |t|
	Mean ±SD	Mean ±SD		Mean ±SD	
Protein(g)	69.70 ± 15.36	66.32 ± 15.02	0.3821	67.97 ± 15.25	0.6584
Carbohydrate(g)	216.00 ± 66.89	213.40 ± 62.56	0.872	218.90 ± 50.52	0.8532
Energy(Kcal)	2129.50 ± 456.90	2130.40 ± 360.20	0.9932	2058.00 ± 441.70	0.5336
Thiamine(mg)	0.98 ± 0.24	0.92 ± 0.22	0.3399	0.98 ± 0.19	0.9475
Riboflavin(mg)	0.56 ± 0.14	0.53 ± 0.14	0.441	0.70 ± 0.79	0.3343
Niacin(mg)	9.56 ± 2.69	9.41 ± 3.08	0.8405	11.20 ± 10.34	0.4052
Folate(µg)	207.10 ± 53.17	208.60 ± 96.25	0.9407	209.60 ± 51.05	0.8534
Vitamin C(mg)	36.89 ± 21.57	35.70 ± 18.35	0.8144	43.31 ± 22.74	0.258
Vitamin D(µg)	1.13 ± 1.12	1.30 ± 1.17	0.5461	0.73 ± 0.79	0.1105
Vitamin E(µg)	51.58 ± 87.01	44.56 ± 75.46	0.7338	62.15 ± 120.60	0.6924
Calcium(mg)	481.70 ± 150.80	447.00 ± 118.90	0.3155	468.10 ± 102.70	0.6778
Chromium(mg)	0.07 ± 0.03	0.07 ± 0.03	0.6041	0.09 ± 0.13	0.4524
Copper(mg)	2.01 ± 0.69	1.72 ± 0.76	0.1178	1.77 ± 0.73	0.6297
Iron(mg)	16.28 ± 5.18	14.65 ± 6.48	0.2748	15.25 ± 5.01	0.2497
Pottasium(mg)	2455.90 ± 763.50	2319.30 ± 814.00	0.4945	2363.60 ± 733.90	0.1944
Selenium((µg)	68.13 ± 20.35	63.01 ± 22.60	0.3483	62.27 ± 19.26	0.4327
Sodium(mg)	2713.60 ± 231.80	2766.00 ± 380.90	0.5105	2749.30 ± 391.80	0.6665
Zinc(mg)	8.01 ± 1.69	7.71 ± 2.06	0.5226	7.80 ± 1.63	0.6186
Omega3(mg)	766.40 ± 352.10	662.70 ± 338.30	0.238	783.10 ± 485.20	0.8768
MUFA(mg)	13591.50 ± 5458.10	11902.00 ± 5529.10	0.227	13448.10 ± 7598.90	0.9319
Vitamin B5(mg)	4.89 ± 1.61	4.21 ± 1.75	0.1155	4.19 ± 1.62	0.0926
Vitamin B6(mg)	1.39 ± 0.44	1.25 ± 0.49	0.2422	1.2 ± 0.45	0.250
Phosphorus(mg	1067.20 ± 369.00	883.50 ± 391.00	0.0599	886.10 ± 385.50	0.0637
Fat(g)	42.30 ± 27.73	47.50± 18.09	0.382	71.8±49.04	0.004
Fibre(g)	42.53 ± 15.28	34.99 ± 16.24	0.0622	36.99 ± 16.76	0.1779
Soluble fibre	8.26 ± 3.64	6.77 ± 3.06	0.0847	7.21 ± 3.47	0.251
SFA(mg)	46072.40 ± 30160.30	38549.10 ± 25315.40	0.2885	36056.40 ± 19070.90	0.1217

Table XLIV reported that there was no remarkable differences between the three study groups in terms of intake of micro and macro nutrients except for intake of total fat that was not a comparable variable between the Experimental I group (M=42.30,SD=27.73and Control group(M=71.8 ,SD=49.04).

The mean values were differed (p=0.0046) significantly. The fat intake of the Experimental group I and Experimental group II (M=47.50,SD=18.09) was not differed significantly. Whereas the Control showed that there was no significant difference in their nutrient intake.

b) Mean nutrient intake of the Participants at baseline compared to Estimated Average Requirements

Table XLV compared the mean nutrient intake of the participants with the Estimated Average Requirement for reproductive age women (20-45 years) .There was a significant difference between EAR and the sample mean(p<0.001) for all macronutrients.

Table XLV Mean nutrient intake of the PCOS Women at baseline compared to EAR

Nutrients	EAR	Experimental I (N=32	Pr>|t|	Experimental II (N=31)	Pr > |t|	Control (N=30)	Pr > |t|
		Mean ±SD		Mean ±SD		Mean ±SD	
Energy (Kcal)	1660	2129.50 ± 456.90	0.00	2130.40 ± 360.20	0.00	2058.00 ± 441.70	0.00
Protein(g)	36.3	69.70 ± 15.36	0.00	66.32 ± 15.02	0.00	67.97 ± 15.25	0.00
Carbohydrates(g)	100	216.00 ± 66.89	0.00	213.40 ± 62.56	0.00	218.90 ± 50.52	0.00
Fat (g)	20	42.30 ± 27.73	0.00	49.06 ± 20.9	0.00	57.5 ± 29.3	0.00
Fibre (g)	25	42.53 ± 15.28	0.00	34.99 ± 16.24	0.00	36.99 ± 16.76	0.00
Soluble fibre (g)	10	8.26±3.64	0.00	6.77±3.06	0.00	7.21±3.47	0.00
Thiamine(mg)	1.5	0.98 ± 0.24	0.00	0.92 ± 0.22	0.00	0.98 ± 0.19	0.00
Riboflavin(mg)	2.1	0.56 ± 0.14	0.00	0.53 ± 0.14	0.00	0.70 ± 0.79	0.00
Niacin(mg)	15	9.56 ± 2.69	0.00	9.41 ± 3.08	0.00	11.20 ± 10.34	0.05
Vitamin B5(mg)	5mg	4.89 ± 1.61	0.701	4.21 ± 1.75	0.017	4.19 ± 1.62	0.010
Vitamin B6(mg)	2.1	1.39 ± 0.44	0.00	1.25 ± 0.49	0.00	1.297±593	0.00
Folate (µg)	180	207.10 ± 53.17	0.007	208.60 ± 96.25	0.108	209.60 ± 51.05	0.003
Vitamin C(mg)	55	36.89 ± 21.57	0.00	35.70 ± 18.35	0.00	43.31 ± 22.74	0.008
Vitamin D(mg)	10	1.13 ± 1.12	0.00	1.30 ± 1.17	0.00	0.73 ± 0.79	0.00
Vitamin E(mg)	75	51.58 ± 87.01	0.00	44.56 ± 75.46	0.00	62.15 ± 120.60	0.00
Calcium (mg)	800	481.70 ± 150.80	0.00	447.00 ± 118.90	0.00	468.10 ± 102.70	0.00
Phosphorus(mg)	1000	1067.20 ± 369.00	0.119	883.50 ± 391.00	0.03	886.10 ± 385.50	0.144
Chromium(mg)	0.05	0.07 ± 0.03	0.006	0.07 ± 0.03	0.008	0.09 ± 0.13	0.10
Copper(mg)	2	2.01 ± 0.69	0.93	1.72 ± 0.76	0.049	1.77 ± 0.73	0.095
Iron(mg)	15	16.28 ± 5.18	0.17	14.65 ± 6.48	0.765	15.25 ± 5.01	0.78

Nutrients	EAR	Experimental I (N=32	Pr>|t|	Experimental II (N=31)	Pr > |t|	Control (N=30)	Pr > |t|
		Mean ±SD		Mean ±SD		Mean ±SD	
Potassium(mg)	3500	2455.90 ± 763.50	0.00	2319.30 ± 814.00	0.00	2363.60 ± 733.90	0.00
Selenium(mg)	40	68.13 ± 20.35	0.00	63.01 ± 22.60	0.00	62.27 ± 19.26	0.00
Sodium(mg)	2000	2713.60 ± 231.80	0.00	2766.00 ± 380.90	0.00	2749.30 ± 391.80	0.00
Zinc (mg)	11	8.01 ± 1.69	0.00	7.71 ± 2.06		7.80 ± 1.63	0.00
Omega3(mg)	1000 mg	766.40 ± 352.10	0.00	662.70 ± 338.30	0.020	783.10 ± 485.20	0.00
MUFA(mg)	36888	13591.50 ± 5458.10	0.00	11902.00 ± 5529.10	0.00	13448.10 ± 7598.90	0.00
SFA(mg)	12911	46072.40 ± 30160.30	0.027	38549.10 ± 25315.40	0.00	36056.40 ± 19070.90	0.00

From Table XLV it was noted that Calorie intake was higher among the Experimental I (M=2129.50 ,SD= 456), Experimental II ,(M=2130.40,SD= 360.20)and for Control(M= 2058.00 SD=441)respectively. Similarly protein intake in Experimental I (M=69.70, SD=15.36), Experimental II (M=66.32 SD= 15.02) and Control (M=67.97 SD= 15.25) was very high compared to the EAR .Carbohydrate and fat, Fibre ($p<0.001$) and SFA ($p<0.05$) had shown a significant increase in their mean values in all the three intervention groups compared to EAR. The micronutrients thiamine , riboflavin , niacin , folic acid , vitamin D , Vitamin E , Calcium , potassium ,selenium , sodium ,zinc and Vitamin B6 , omega 3 fatty acids , MUFA showed a considerable decrease in mean value compared to EAR ($p<0.001$In his experiments, Schaefer (2019) has demonstrated the importance of micronutrients for female fertility and the negative effects they might have when ingested in insufficient amounts. Folate and Vitamin A are crucial for the quality of the oozyte, fertilisation, and implantation. Vitamins B6, B12, D, and iron also play a part in mechanisms that affect fertility rate.Zinc for Menstrual cycle regularisation (Gaskins et al 2015) .Vitamin C , E and A are defend against reactive oxygen species .Infertile women appear to have low levels of Vitamin B6 compared to fertile women.Vitamin D deficiency is also associated with PCOS and decreased fertility (Grajecki et al, 2012). Studies executed by Schaefer et al (2016)among women of reproductive age in the industrialised countries also proved that the lower levels of micronutrients such as folate , vitamin B12 , Vitamin D ,Calcium , Iodine ,Iron and Selenium compared to the recommended allowances are responsible for the precipitation of infertility especially among women of reproductive age .This is in agreement with the findings of our study in the current study Iron Phosphorus and Vitamin B5 , Chromium were the micronutrients which had the adequate intake compared to EAR. Mean intake of folate was higher compared to EAR.

c) Comparison of Nutrient intake in the Experimental group I before and after Nutrition interventions

Table XLVI indicated that the mean difference in nutrient intake among the participant in the Experimental group I before and after the Intervention.

Table XLVI Mean Nutrient Intake of the participants in the Experimental group I

Nutrients	"Mean ± SD" before	"NAR "	"Mean ± SD" After	NAR	"Mean difference ± SD"	P value
Energy (Kcal)	2129.50 ± 456.90	1.28	1180.70 ± 375.70	0.71	-948.80 ± 556.70	<.0001
Protein(g)	69.70 ± 15.36	1.90	52.07 ± 18.54	1.43	-17.63 ± 23.39	0.0002
Carbohydrates(g)	216.00 ± 66.89	2.16	142.50 ± 35.81	1.42	-73.51 ± 67.90	<.0001
Fat (g)	42.30 ± 27.73	2.12	40.49 ± 27.99	2.02	-1.81 ± 3.33	0.0044
Fibre (g)	42.53 ± 15.28	1.7	32.32 ± 10.85	1.29	-10.21 ± 17.41	0.0023
Soluble fibre (g)	8.26±3.64	0.83	6.42 ± 2.21	0.64	-1.83 ± 3.59	0.007
Thiamine(mg)	0.98 ± 0.24	0.65	0.79 ± 0.28	0.53	-0.18 ± 0.40	0.0149
Riboflavin(mg)	0.56 ± 0.14	0.27	0.46 ± 0.41	0.20	-0.10 ± 0.47	0.2396
Niacin(mg)	9.56 ± 2.69	0.63	8.48 ± 3.59	0.56	-1.08 ± 4.65	0.1978
Vitamin B5(mg)	4.89 ± 1.61	0.97	4.01 ± 2.51	0.80	-0.88 ± 3.42	0.1541
Vitamin B6(mg)	1.39 ± 0.44	0.66	1.02 ± 0.40	0.48	-0.37 ± 0.49	0.0002
Folate (µg)	207.10 ± 53.17	1.15	183.80 ± 64.44	1.0	-23.36 ± 88.65	0.1461
Vitamin C(mg)	36.89 ± 21.57	0.67	50.86 ± 33.67	0.92	13.97 ± 38.81	0.0504
Vitamin D(mg)	1.13 ± 1.12	0.11	0.24 ± 1.92	0.02	-0.88 ± 2.29	0.037
Vitamin E(mg)	51.58 ± 87.01	0.69	6.06 ± 2.88	0.08	-46.52 ± 86.66	0.0048
Calcium (mg)	481.70 ± 150.80	0.60	345.00 ± 148.50	0.43	-136.80 ±180.90	0.0002
Phosphorus(mg)	1067.20 ± 369.00	1.06	756.80 ± 250.10	0.76	-310.40 ±425.70	0.0003
Chromium(mg)	0.07 ± 0.03	1.4	0.03 ± 0.02	0.60	-0.04 ± 0.04	<.0001
Copper(mg)	2.01 ± 0.69	1.05	1.47 ± 0.51	0.74	-0.54 ± 0.81	0.0006
Iron(mg)	16.28 ± 5.18	1.08	10.83 ± 5.35	0.72	-5.45 ± 7.04	0.0001
Potassium(mg)	2455.90±763.50	0.70	1997.60 ± 630.60	0.57	-458.30 ±889.50	0.0066
Selenium(mg)	68.13 ± 20.35	1.7	75.78 ± 31.87	1.89	7.65 ± 39.29	0.279
Sodium(mg)	2713.60 ± 231.80	1.36	2531.30 ± 67.74	1.27	-182.30 ± 241.60	0.0002
Zinc (mg)	8.01 ± 1.69	0.73	6.16 ± 2.19	0.56	-1.86 ± 2.97	0.0013
Omega3(mg)	766.40 ± 352.10	0.77	637.30 ± 329.90	0.64	-129.10 ± 228.60	0.0032
MUFA(mg)	13591.50 ± 5458.10	0.37	8724.00 ± 6010.90	0.24	-4867.50 ± 91.70	0.005
SFA(mg)	46072.40 ± 30160.30	3.5	18389.90 ± 17081.60	1.42	-27682.50 ± 31882.80	<.0001

NAR: Nutrient Availability Ratio

Table XLVII revealed that, There was a considerable significant decrease in the mean values of Energy, Carbohydrate, fat and Fibre ($p<0.001$) in the Experimental group I after the Nutrition intervention. B complex vitamins thiamine and vitamin B6 had shown significant mean decrease (M=-0.18, SD=0.40), (M=-0.37, SD= 0.49) ($P<0.001$) respectively. Fat soluble vitamins, Vitamin D and Vitamin E had shown significant decrease after the intervention ($P<0.05$). Micro minerals such as Calcium, Phosphorus , Chromium ,Iron , Copper , Zinc , Potassium , Sodium had shown significant decrease after the Nutrition intervention .Omega 3 fatty acid , Saturated fatty acid and Monounsaturated fatty acid also had shown mean significant decrease after nutrition supplementation in the Experimental group I. There was a significant decrease in the intake of protein and vitamin E between the women in all the three nutrition intervention groups ($p<0.001$) .Calories Carbohydrate, vitamin D, Saturated fatty acid intake decreased significantly in the Experimental I and Experimental II group<0.05). Calcium intake had reduced in the Experimental I and Control group ($p<0.001$). The mean intake of thiamine , chromium , copper , Iron , potassium, sodium , zinc , MUFA , Vitamin B6 , Phosphorus and fibre had significantly decreased in the Experimental group I ($p<0.001$).Intake of omega 3 fatty acid had decreased in the nutrition intervention group but increased in the control group .Intake of several micronutrients had decreased considerably because , many of the participants had decreased their portions, which in turn resulted in decreased calorie and carbohydrate intake. After the education session the mean intake of calorie($p=0.0011$), protein($p=0.0158$), carbohydrate($p<.0001$) , vitamin C($p=0.0147$), Vitamin D($p= 0.0232$), Vitamin E($p=0.0057$)and saturated fatty acids($p=0.0248$)has reduced significantly .For control group ,the intake of protein, vitamin E , Calcium , Omega 3 fatty acid has reduced to ($p<0.001$) .Between the Experimental I and Control no significant difference was observed in the mean values of Chromium, Iron, Copper, phosphorus and Vitamin B5.

The compliance of Micro nutrient dense health mix in the Experimental group I was assessed weekly. A weekly telephonic follow up was done on all the participants in the Experimental group I . They were asked to return the unused / remaining opened packets when they come for follow up . Except three patients who returned less than ¼ th packet , there were no compliance issues.

d) Comparison of Nutrient intake in the Experimental group II before and after Nutrition interventions

The comparison of nutrient intake of the participants in the Experimental group II is represented in table XLVII

Table XLVII Mean Nutrient Intake of the participants in the Experimental group II

Nutrients	"Mean ± SD" before	"Mean ± SD" After	"Mean difference ± SD"	P value
Energy (Kcal)	2130.40 ± 360.20	1419.10 ± 420.10	-711.40 ± 505.10	<.0001
Protein(g)	66.32 ± 15.02	50.34 ± 20.68	-15.99 ± 24.69	0.0011
Carbohydrates(g)	213.40 ± 62.56	177.40 ± 54.45	-36.04 ± 78.45	0.0158
Fat (g)	49.06 ± 20.9	51.14 ± 24.36	0.00 ± 0.00	0.00
Fibre (g)	34.99 ± 16.24	36.84 ± 18.77	1.85 ± 26.03	0.6945
Soluble fibre (g)	6.77±3.06	7.28 ± 3.95	0.51 ± 4.90	0.5672
Thiamine(mg)	0.92 ± 0.22	0.85 ± 0.41	-0.07 ± 0.45	0.4001
Riboflavin(mg)	0.53 ± 0.14	0.52 ± 0.27	-0.01 ± 0.30	0.8734
Niacin(mg)	9.41 ± 3.08	9.76 ± 4.97	0.35 ± 5.10	0.7078
Vitamin B5(mg)	4.21 ± 1.75	200.60 ± 94.70	-0.52 ± 2.19	0.1952
Vitamin B6(mg)	1.25 ± 0.49	1.09 ± 0.47	-0.16 ± 0.61	0.1526
Folate (µg)	208.60 ± 96.25	200.60 ± 94.70	-8.02 ± 138.40	0.7492
Vitamin C(mg)	35.70 ± 18.35	70.38 ± 70.36	34.68 ± 74.57	0.0147
Vitamin D(mg)	1.30 ± 1.17	0.63 ± 0.91	-0.67 ± 1.56	0.0232
Vitamin E(mg)	44.56 ± 75.46	3.93 ± 3.27	-40.63 ± 76.03	0.0057
Calcium (mg)	447.00 ± 118.90	385.60 ± 154.70	-61.44 ± 98.10	0945
Phosphorus(mg)	883.50 ± 391.00	838.90 ± 412.10	-44.65 ±491.20	0.6165
Chromium(mg)	0.07 ± 0.03	0.06 ± 0.03	-0.01 ± 0.04	0.3218
Copper(mg)	1.72 ± 0.76	1.65 ± 0.78	-0.07 ± 1.09	0.7106
Iron(mg)	14.65 ± 6.48	14.19 ± 7.90	-0.46 ± 9.07	0.7794
Potassium(mg)	2319.30 ± 814.00	2175.90 ± 1018.50	-143.40 ± 1281.60	0.5379
Selenium(mg)	63.01 ± 22.60	72.86 ± 51.75	9.85 ± 55.70	0.3327
Sodium(mg)	2766.00 ± 380.90	2664.30 ± 273.50	-101.70 ± 375.20	0.1417
Zinc (mg)	7.71 ± 2.06	6.65 ± 3.06	-1.05 ± 3.45	0.0991
Omega3(mg)	662.70 ± 338.30	654.20 ± 358.50	-8.50 ± 84.59	0.5801
MUFA(mg)	11902.00 ± 5529.10	9515.40 ± 6776.20	-2386.60 ± 8142.90	0.1132
SFA(mg)	38549.10 ± 25315.40	27185.20 ± 15151.50	-11363.80 ± 26772.00	0.0248

Table XLVII revealed that there was a considerable significant decrease in the mean values of Energy, Carbohydrate, fat ($p<0.001$) in the Experimental group II after the Nutrition intervention. None of the B complex vitamins had shown significant difference in the mean values after the intervention. Vitamin C Vitamin D and Vitamin E had shown significant decrease after the intervention ($P<0.05$).Micro minerals such as Calcium,

Phosphorus ,Chromium , Iron , Copper , zinc , Potassium , Selenium , Sodium, MUFA and Omega 3 fatty acid had shown no significant d after the nutrition intervention. Whereas SFA has shown significant difference after the intervention (P=0.025)

e) Comparison of Nutrient intake in the Control group before and after Nutrition interventions

Comparison of nutrient intake in the control group before and after nutrition intervention is represented in table XXIX

Table XLVIII Mean Nutrient Intake of the participants in the Control group

Nutrients	Mean ± SD before	Mean ± SD After	Mean difference ± SD	NAR	P value
Energy (Kcal)	2058.00 ± 441.70	1932.10 ± 739.70	-711.40 ± 505.10		0.3705
Protein(g)	67.97 ± 15.25	51.84 ± 17.14	-15.99 ± 24.69		0.0011
Carbohydrates(g)	218.90 ± 50.52	235.90 ± 81.79	-36.04 ± 78.45		0.3809
Fat (g)	57.5 ± 29.3	78.40 ± 59.07	0.00 ± 0.00		0
Fibre (g)	36.99 ± 16.76	34.55 ± 14.25	1.85 ± 26.03		0.5128
Soluble fibre (g)	7.21±3.47	6.64 ± 2.74	0.51 ± 4.90		0.4363
Thiamine(mg)	0.98 ± 0.19	0.87 ± 0.43	-0.07 ± 0.45		0.2358
Riboflavin(mg)	0.70 ± 0.79	0.55 ± 0.45	-0.01 ± 0.30		0.3569
Niacin(mg)	11.20 ± 10.34	11.44 ± 5.40	0.35 ± 5.10		0.9002
Vitamin B5(mg)	4.19 ± 1.62	3.90 ± 1.75	-0.52 ± 2.19		0.4901
Vitamin B6(mg)	1.297±593	1.32 ± 0.59	-0.16 ± 0.61		0.3261
Folate (µg)	209.60 ± 51.05	197.30 ± 93.69	-8.02 ± 138.40		0.5285
Vitamin C(mg)	43.31 ± 22.74	50.76 ± 51.70	34.68 ± 74.57		0.4709
Vitamin D(mg)	0.73 ± 0.79	0.73 ± 0.96	-0.67 ± 1.56		0.9672
Vitamin E(mg)	62.15 ± 120.60	3.12 ± 2.21	-40.63 ± 76.03		0.0116
Calcium (mg)	468.10 ± 102.70	347.30 ± 123.70	-61.44 ± 198.10		0.0004
Phosphorus(mg)	886.10 ± 385.50	831.80 ± 354.00	-44.65 ± 491.20		0.5468
Chromium(mg)	0.09 ± 0.13	0.05 ± 0.03	-0.01 ± 0.04		0.1371
Copper(mg)	1.77 ± 0.73	1.67 ± 0.71	-0.07 ± 1.09		0.5562
Iron(mg)	15.25 ± 5.01	13.52 ± 6.12	-0.46 ± 9.07		0.2022
Potassium(mg)	2363.60 ± 733.90	2164.30 ± 888.80	-143.40 ± 1281.60		0.3105
Selenium(mg)	62.27 ± 19.26	64.32 ± 42.15	9.85 ± 55.70		0.8144
Sodium(mg)	2749.30 ± 391.80	2778.70 ± 710.10	-101.70 ± 375.20		0.7712
Zinc (mg)	7.80 ± 1.63	6.70 ± 2.88	-1.05 ± 3.45		0.0761
Omega3(mg)	783.10 ± 485.20	789.80 ± 485.10	-8.50 ± 84.59		<.0001
MUFA(mg)	13448.10 ± 7598.90	13723.00 ± 18999.80	-2386.60 ± 8142.90		0.9408
SFA(mg)	36056.40 ± 19070.90	42604.30 ± 36455.20	-11363.80 ± 26772.00		0.4339

Table XLVIII revealed that among the participants of the control group, there was significant decrease in the mean values of protein (M=15.99, SD=24.69), Vitamin E (M=40.63, SD= 76.03), Calcium (M=61.44, SD=198.10) and Omega 3 fatty acid (M=8.50, SD=84.59).Energy intake and Macronutrient intake had not significantly differed after intervention. Micronutrients such as B complex Vitamins and Micro minerals such as calcium, Iron, Phosphorus, Chromium, Copper, Zinc, Potassium, and Sodium had not shown significant decrease after the intervention. Saturated fatty acid and Monounsaturated fatty acid also had shown mean significant decrease after nutrition supplementation in the Experimental group.

f) Comparison of Nutrient intake of the participants before and after nutrition interventions

Table XLIX indicated that those who received nutrition education had significantly reduced the intake of calorie, carbohydrate, chromium , sodium and saturated fat (p<001) .

Table XLIX Comparison of nutrient intake between the study groups after Nutrition Intervention

Variable	Experimental I	Experimental II	Sig	Control	Sig
	Mean ± SD	Mean **± SD**	Pr > |t|	Mean ± SD	Pr > |t|
Protein(g)	52.07 ± 18.54	50.34 ± 20.68	0.7278	51.84 ± 17.14	0.960
Carb(g)	142.50 ± 35.81	177.40 ± 54.45	0.0043	235.90 ± 81.79	<.000
Energy Kcal	1180.70 ± 375.70	1419.10 ± 420.10	0.0207	1932.10 ± 739.70	<.000
Thiamine (mg)	0.79 ± 0.28	0.85 ± 0.41	0.5266	0.87 ± 0.43	0.397
Riboflavin (mg)	0.46 ± 0.41	0.52 ± 0.27	0.4587	0.55 ± 0.45	0.384
Niacin(mg)	8.48 ± 3.59	9.76 ± 4.97	0.2446	11.44 ± 5.40	0.015
Folate(µg)	183.80 ± 64.44	200.60 ± 94.70	0.4151	197.30 ± 93.69	0.513
VitC(mg)	50.86 ± 33.67	70.38 ± 70.36	0.1694	50.76 ± 51.70	0.993
VitD µg)	0.24 ± 1.92	0.63 ± 0.91	0.3118	0.73 ± 0.96	0.209
VitE(mg)	5.06 ± 2.88	3.93 ± 3.27	0.1503	3.12 ± 2.21	0.004
Calcium(mg)	345.00 ± 148.50	385.60 ± 154.70	0.2917	347.30 ± 123.70	0.947
Chromium(mg)	0.03 ± 0.02	0.06 ± 0.03	0.0003	0.05 ± 0.03	0.002
Copper(mg)	1.47 ± 0.51	1.65 ± 0.78	0.2897	1.67 ± 0.71	0.190
Iron(mg)	10.83 ± 5.35	14.19 ± 7.90	0.0541	13.52 ± 6.12	0.070
Pottasium(mg)	1997.60 ± 630.60	2175.90 ± 1018.50	0.4093	2164.30 ± 888.80	0.396
Selenium(mg)	75.78 ± 31.87	72.86 ± 51.75	0.7892	64.32 ± 42.15	0.230
Sodium(mg)	2531.30 ± 67.74	2664.30 ± 273.50	0.0128	2778.70 ± 710.10	0.067
Zinc(mg)	6.16 ± 2.19	6.65 ± 3.06	0.4598	6.70 ± 2.88	0.402

Omega3 Fatty acid (mg)	637.30 ± 329.90	654.20 ± 358.50	0.8465	789.80 ± 485.10	0.157
MUFA(mg)	8724.00 ± 6010.90	9515.40 ± 6776.20	0.6254	13723.00 ± 18999.80	0.177
VitB5(mg)	4.01 ± 2.51	3.69 ± 1.77	0.5655	3.90 ± 1.75	0.852
VitB6(mg)	1.02 ± 0.40	1.09 ± 0.47	0.536	1.32 ± 0.59	0.027
Phosphorus(mg)	756.80 ± 250.10	838.90 ± 412.10	0.3457	831.80 ± 354.00	0.337
Fat(g)	40.49 ± 27.99	51.14 ± 24.36	0.1129	78.40 ± 59.07	0.003
Fibre(g)	32.32 ± 10.85	36.84 ± 18.77	0.25	34.55 ± 14.25	0.491
Sol Fibre (g)	6.42 ± 2.21	7.28 ± 3.95	0.2961	6.64 ± 2.74	0.725
SFA(mg)	18389.90 ± 17081.60	27185.20 ± 15151.50	0.0347	42604.30 ± 36455.20	0.002

From table XLIX it can be concluded that the mean intake of carbohydrate (p,0.001) and Energy (p=<0.001) significantly differed between the Experimental I and II and between" Experimental I" and Control group (p=000).Similarly there was a remarkable decrease in the mean intake of Saturated fatty acid, chromium and Sodium in all the intervention groups (p<0.05). Comparison of intervention and Control group showed a significant difference among carbohydrate, calorie, niacin , vitamin E , Chromium , Niacin and saturated fatty acid**.**

G) Assessment of Individual Dietary Diversity Score

The Food frequency questionnaire and 24 hour recall method was used for the measurement of IDDS Twelve food groups was used for measurement of Household Dietary Diversity Score indicator .Each food group was assigned a score of 1 (if consumed) or 0 (if not consumed). By this way in which from the 24 hour recall, the food groups taken was noted and summed up to get scores for each person (ranging from 1 to 12 The household score will range from 1 to 12(1 will be the lowest and 12 will be the highest score)

HDDS (1-12)= Sum IDDS (A+B+C+D+E+F+G+H+I+J+K+L)/

Average IDDS = Sum IDDS/ Total Number of Individuals

a) Consumption of different food groups and Individual Dietary Diversity Score

Individual dietary intake was collected using 24 hour recall and Food frequency questionnaire.PCOS women used cent per cent cereals, and Fats and oils, Pulses and legumes were consumed by 84.9 per cent of subjects. .Consumption of different food groups and distribution of individual dietary diversity score is represented in table L

Table L Consumption of Different food groups and Distribution of Individual Dietary Diversity Score (n=93)

Food Groups	With out MFIR		IDDS	With out MFIR	
	n	per cent		n	per cent
Cereals and Grains	93	100	1	0	0
Pulses and Legumes	79	84.9	2	0	0
Meat /poultry &Fish	78	83	3	0	0
Roots and tubers	74	79.5	4	0	0
Green leafy vegetables	48	51.6	5	3	3.2
Vegetables	89	95.4	6	4	4.4
Eggs	73	78.4	7	9	9.7
Milk and milk products	68	73	8	12	12.9
Oils and fats Fruits	93	100	9	15	16.1
Fruits	67	72	10	19	20.4
Sugar /honey	44	47.3	11	20	21.5
Miscellaneous	52	55.9	12	11	11.8
			(M= 7.75 SD=7.60		

From the table L it can be concluded that the average Individual Dietary diversity score was found to be7.75.About 3.2 per cent of participants consumed 5 food groups, 4.4 per cent consumed 6 food groups,9.7 per cent,7 food groups ,12.9 per cent 8 food groups , 16.1 per cent of participants consumed 9 food groups and More than 20.4 per cent of participants consumed 10 food groups . More than 21.5 per cent participants consumed 11 foods groups and 11.8 per cent were consumed 12 food groups

H) Impact of nutrition education on the knowledge of PCOS among the selected participants

In the current study a small booklet containing information regarding pathophysiology, diagnostic evaluation, symptoms, risk factors, complications, management and prevention of symptoms of PCOS was provided to the subjects in the Experimental group I and II. The impact of nutrition education on the knowledge scores of Participants is represented in table LI

Table LI Impact of nutrition education on the knowledge of PCOS among the selected participants

Knowledge level	Pre test		Post test		Level of knowledge	Mean ±SD	Mean difference	Wilcoxon Signed rank test	
	N	Per cent	n	Per cent				Z value	P value
Poor (0-6)	10	15.8	0	0					
Average (7-12)	34	53.9	2	3.1	Pre test	10.25 ±3.65	-6.16 ±3.40	-6.88[b]	.000
Good (13-20)	19	30	61	96.8	Post test	16.41 ±1.91			

Table LI reveals the mean scores of various aspect that among the participants. The mean pre-test score was 10.25±3.64.The pre-test findings showed that more than 54 per cent of subjects had average knowledge. Sixteen per cent of subjects had poor knowledge and 30 per cent had good knowledge. The mean post test score was found to be 16.4±1.90 .More than 98 per cent of subjects was found to have good knowledge in the post test whereas 1.57 per cent of subjects had average knowledge. Regarding knowledge assessment on PCOS.The analysis of the results revealed that the mean scores were significantly different for the pretest and post-test .The mean difference in the pre-test and post test score was -6.16±3.39.In order to evaluate there is increase in knowledge of PCOS participants after the administration of education module , Wilcoxon signed rank test revealed a statistically significant positive change following the education , Z=-6.876, P=0.001, with a large effect size (r=0.86).The study revealed that the education module was effective to increase the knowledge of the participants of the study. Mean knowledge scores of Participants in the study group is represented in figure 24

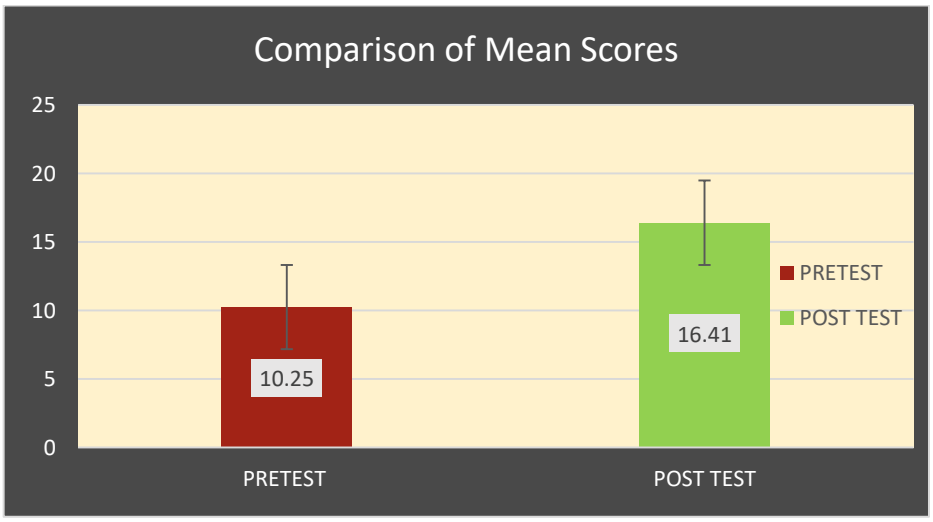

Figure 24 Comparison of mean knowledge scores of Participants in the study group

PHASE VI Statistical Analysis of the collected Data

The statistical analysis was done using SPSS Version 23, SAS University Edition software

A) Determined factors influencing the PCOS variables by Repeated measures analysis

The difference in difference of PCOS symptoms over time were assessed using Generalised linear model and by using repeated measures analysis and was found to have significant difference within and between the study groups ($p<0.05$) .

i) A comparison of the average weight of the individuals in the experimental group I and II

Figure 25 compares the mean body weight of the Experimental group I and II participants before and after the intervention. At the start of the trial, the weight was comparable (p=0.80), and there was no significant difference between the therapies at the conclusion (p=0.30). Both Experimental groups I and II had substantial changes over time (p 0.001). Additionally, there was a significant difference in the rate of change (p0.001)

ii) A comparison of the participants' mean weights of the study Group Experimental I and Control

Figure 25 compares the mean weight of the participants in the Education + supplementation group (ExptI) and Medication Group (Control) before and after the intervention. The weight was comparable at the baseline (p=0.98). At the conclusion of the trial, there was no discernible difference between the therapies (p=0.30). While the Control group's change over time was not significant (p=0.80), it was significant for Experimental group I (p0.001). Additionally, there was a significant difference in the pace of change (p 0.001).

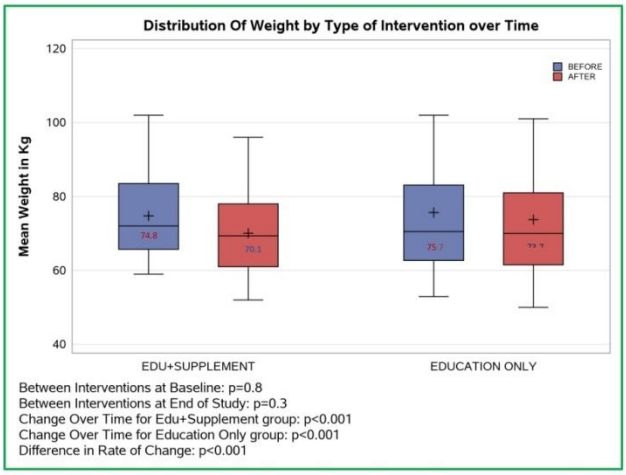

Figure 25 Comparison of mean weight of the participants in study groups

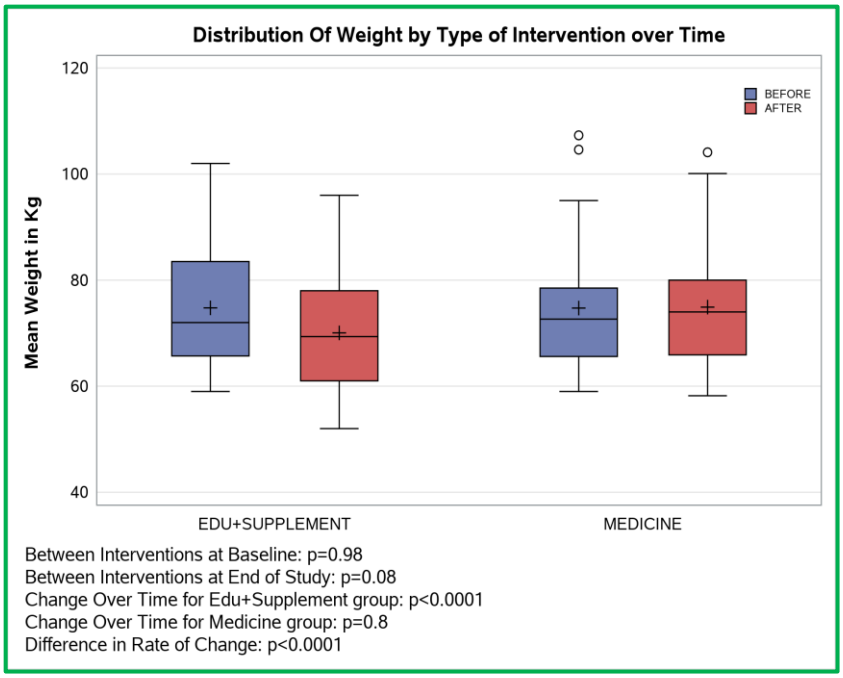

Figure 25 Comparison of mean weight of the participants in study groups

iii) Comparison of mean BMI of the participants in the Experimental group I and II

Figure 26 portrayed **t**he mean BMI of the participants in the Experimental group I and II compared before and after intervention. At base line the BMI was comparable (P=0.50) .No significant change in the BMI at the end of the intervention (p=0.20).The change over time for Experimental group I and Experimental group II were significant (p<0.001).The difference in the rate of change was also significant. (p=0.003)

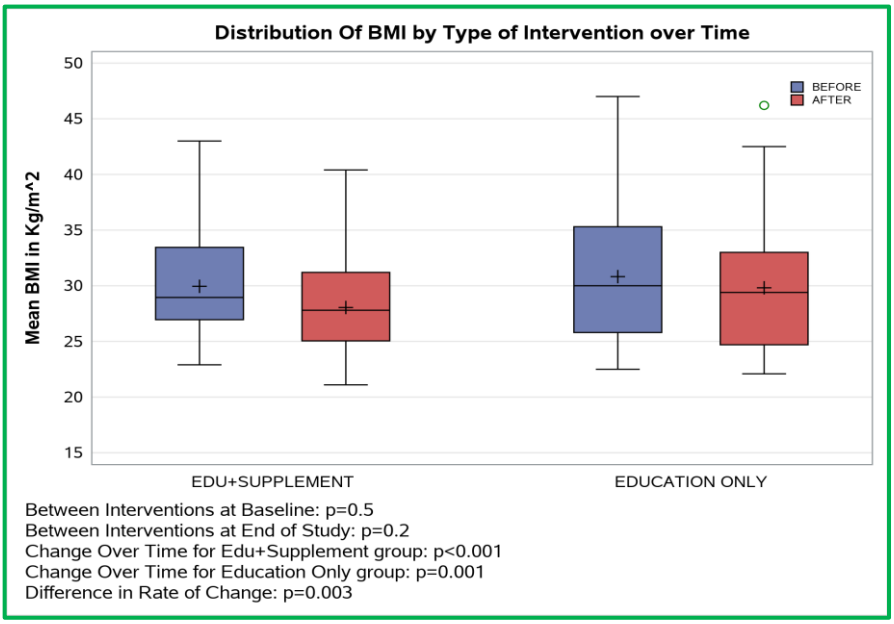

Figure 26 Comparison of mean BMI of the participants of the study groups

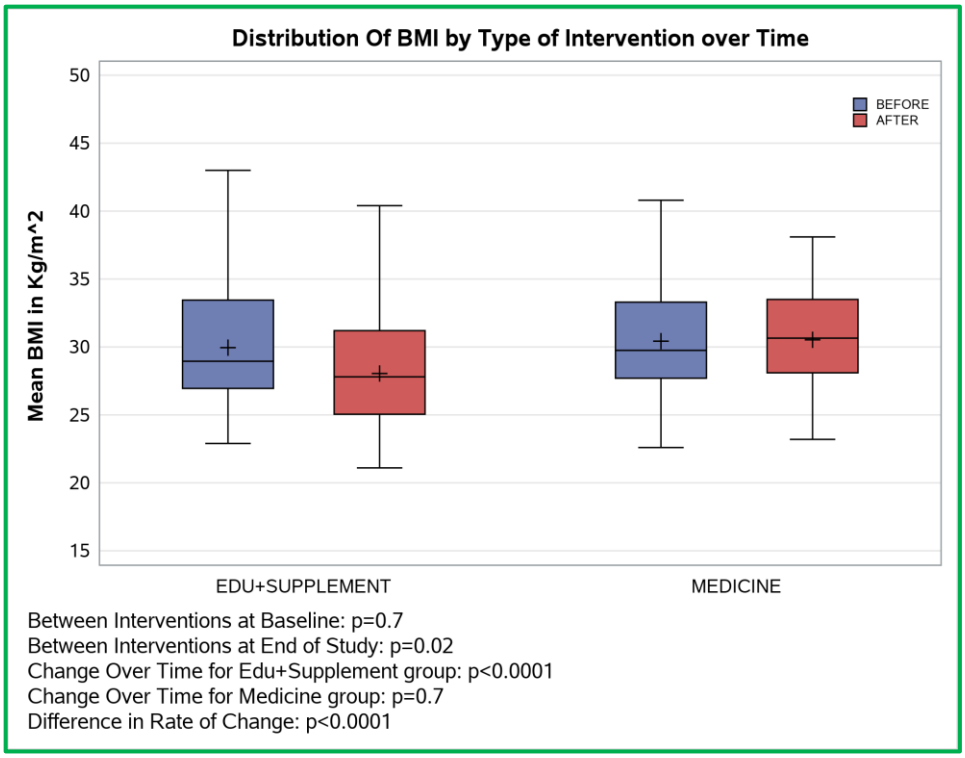

Figure 26 Comparison of mean BMI of the participants of the study groups

iv) A comparison of the experimental group I participants' mean BMI and the control group

The mean BMI of the participants in Experimental group I and the control group was shown in Figure 26 before and after the intervention. The BMI was comparable at the beginning (P=0.70). At the conclusion of the trial, there was a significant difference in BMI (p=0.02). While the control group's change over time was not significant (p=0.70), it was significant for Experimental group I (p<0.001). Additionally important was the difference in the rate of change. (p<0.0001)

v) A comparison of the experimental group I and II participants' mean Triceps skin fold thickness

Figure 27 compares the thickness of the Triceps skinfold in the Study group Education+supplement and Education alone before and after the intervention. TSF was equivalent between groups at baseline (P=0.20), and there was no difference between the groups at study's conclusion (p=0.80). Both the Experimental group I and the Control group experienced substantial changes over time (p< 0.001). Significant variation in change rate was also detected (p=0.03).

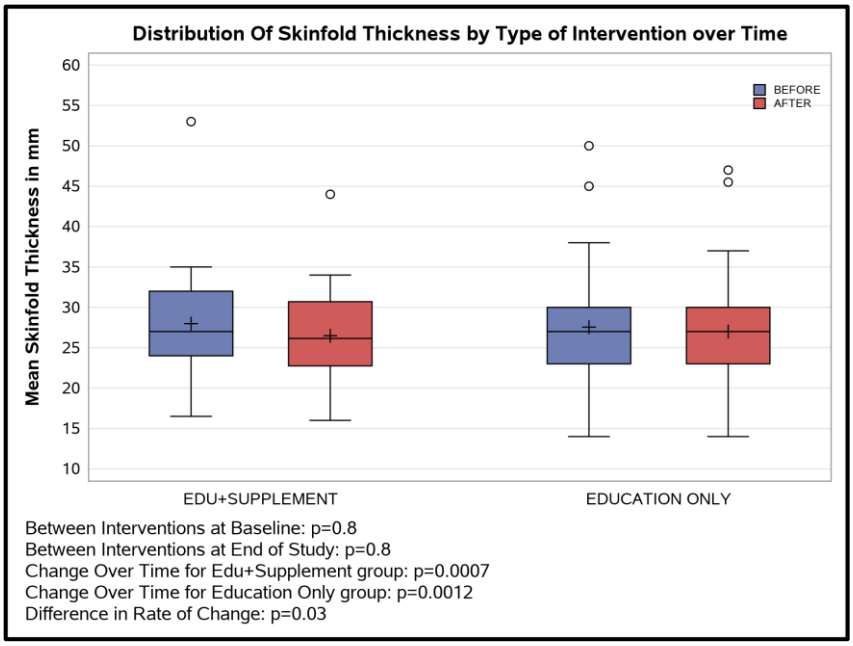

Figure 27 Comparison of mean TSF of the participants of the study groups

vi) A comparison of the participants' mean Triceps skin fold thickness between Supplementation Education group and Medication group

Figure 27 compares the Triceps skinfold thickness of the participants in the Experimental group I and control group before and after the intervention.TSF was equivalent between groups at baseline (P=0.90), and there was no difference between the groups at study's conclusion (p=0.30).Compared to the control group, the change over time for Experimental group I was significant (p=0.000) and for control group it was non-significant (p=0.90).A significant difference in change rate was also detected (p=0.002).

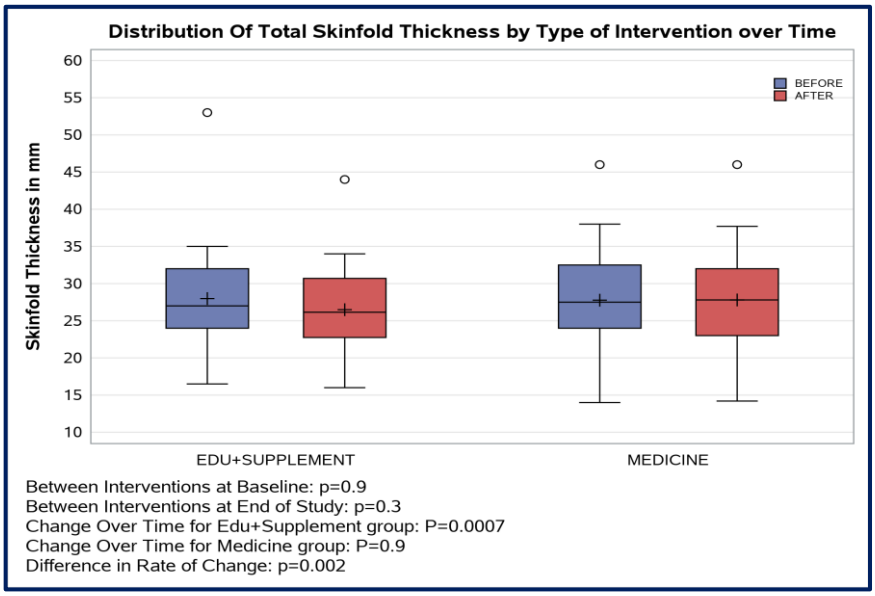

Figure 27 Comparison of mean TSF of the participants in the study groups

vii) Comparison of mean Waist circumference (WC) of the participants in the Experimental group I and II

The mean waist circumference of the participants in the Experimental group I and II compared before and after intervention and is represented in Figure28. At base line WC was comparable (P=0.20) and between the groups at the end of the study was significant (p=0.02).The change over time for Experimental group I was significant (p<0.000) and was not significant for Experimental group II (p=0.60).The difference in rate of change was also significant (p<0.001)

viii) Comparison of mean Waist circumference (WC) of the participants in the Experimental group I and Control group

The mean waist circumference of the participants in the Experimental group I and control group compared before and after intervention and is denoted in Figure 28. Baseline values of WC was comparable (P=0.60).There was no significant difference in waist circumference at the end of the study (p=0.30).The change over time was significant (p<0.001) for Experimental group I and was insignificant for control group II (p=0.97).The difference in the rate of change was also significant (p<0.0001)

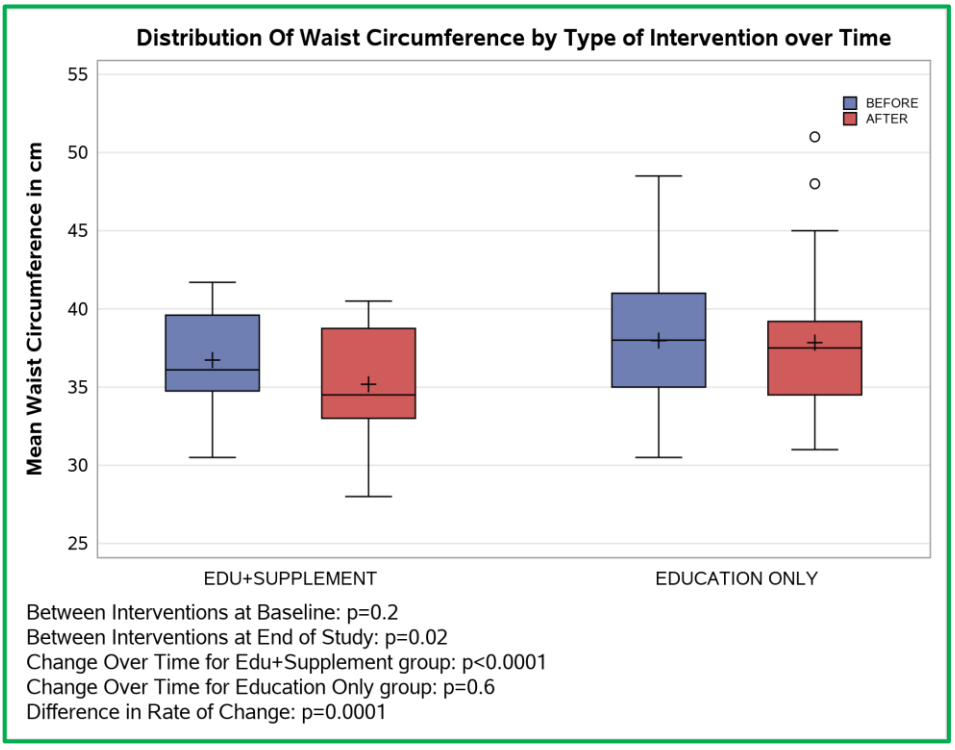

Figure 28 Comparison of mean waist circumference of the participants

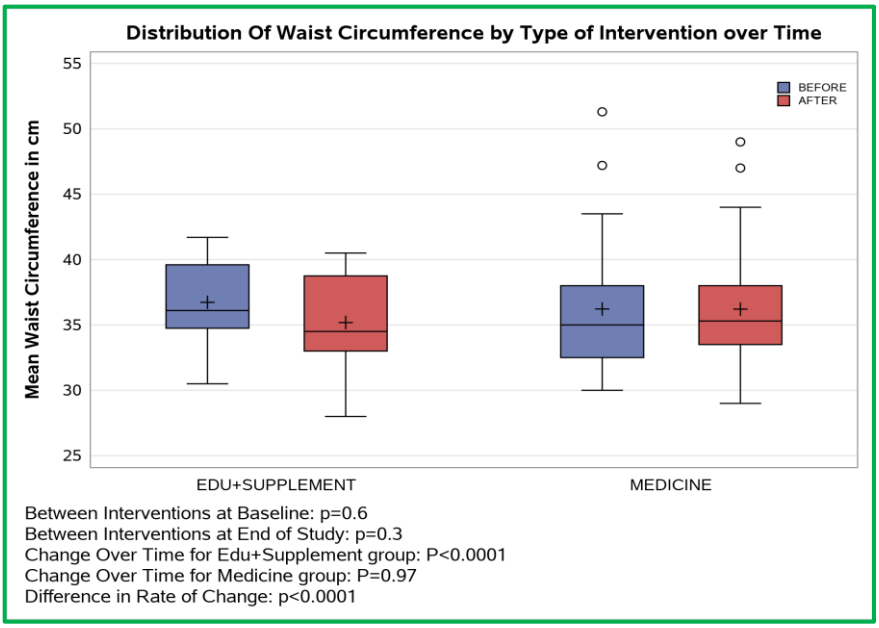

Figure 28 Comparison of mean waist circumference of the participants

ix) A Comparison of Experimental group I and II participants mean Hip circumference (HC)

Figure 29 compares the mean hip circumference of the Experimental study group I and II participants before and after intervention. HC was comparable at baseline (P=0.10) At study's conclusion, a significant difference between the therapies (p=0.02) were observed . Experimental group II's change over time was not significant (p=0.5), however it was significant for experimental group I (p=0.000). Significant differences in change rates were discovered (p=0.007).

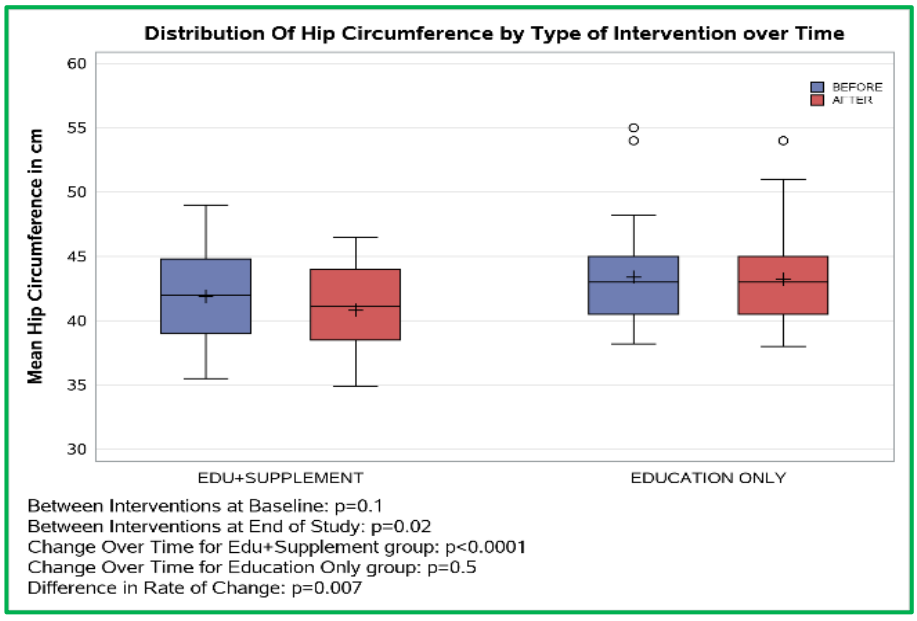

Figure 29 Comparison of mean HC of the participants

x) Comparison of mean Hip circumference (HC) of the participants in the Experimental group I and Control group

The mean hip circumference of the participants in the Experimental group I and control group compared before and after intervention and is depicted in Figure 29. HC was comparable (P=0.90) before the initiation of the study .The mean values of Hip circumference between the interventions at the end of the study was not significant (p=0.20).The change over time for experimental group I and was significant (p=0.000) and for control group was also not significant (p=0.40).There was a significant difference in the rate of change when compared between the two groups(p=0.000).

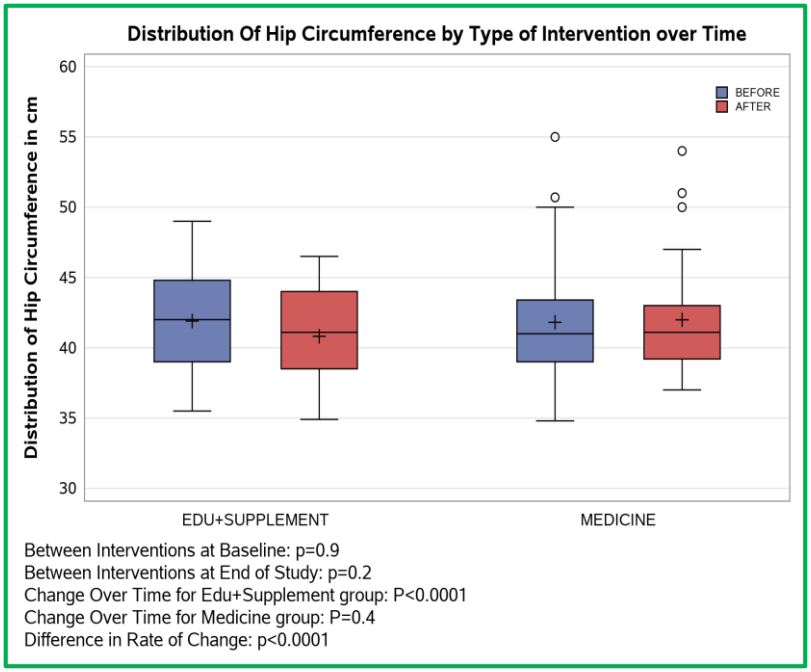

Figure 29 Comparison of mean HC of the participants in the study groups

xi) Comparison of mean Body fat of the participants in the Experimental group I and II

Figure 30 depicted the mean body fat among the participants in the Experimental group I and II compared before and after intervention. At base line the body fat was comparable (P=0.70) and at the end of the study there was significant difference seen between the two groups (p=0.03) .The change over time was significant both in the "Experimental group I and II" (p<0.001).The difference in rate of change was also significant (p=0.002)

xii) Comparison of mean Body fat of the participants in the Experimental group I and Control group

Figure 30 depicted the mean body fat of the participants in the Experimental group I and control group compared before and after intervention. At base line the body fat was

comparable (P=0.96) and at the end of the study there was no significant difference seen between the two groups (p=0.95) .The change over time was significant for experimental group I(p=0.001) and not significant for control group(p=0.20).The difference in rate of change was also significant (p=0.000)

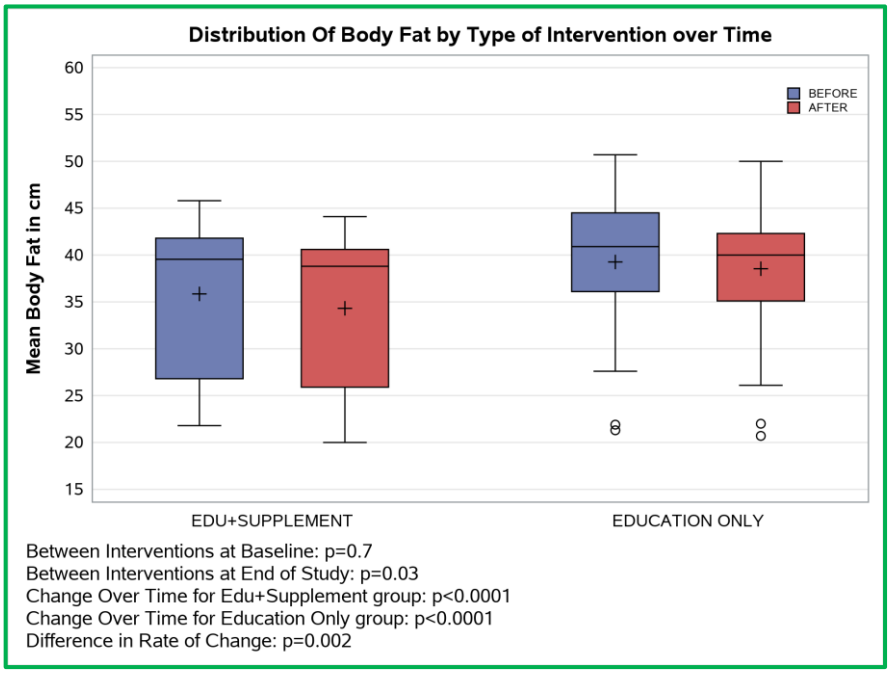

Figure 30 Comparison of average body fat of the participants between study groups

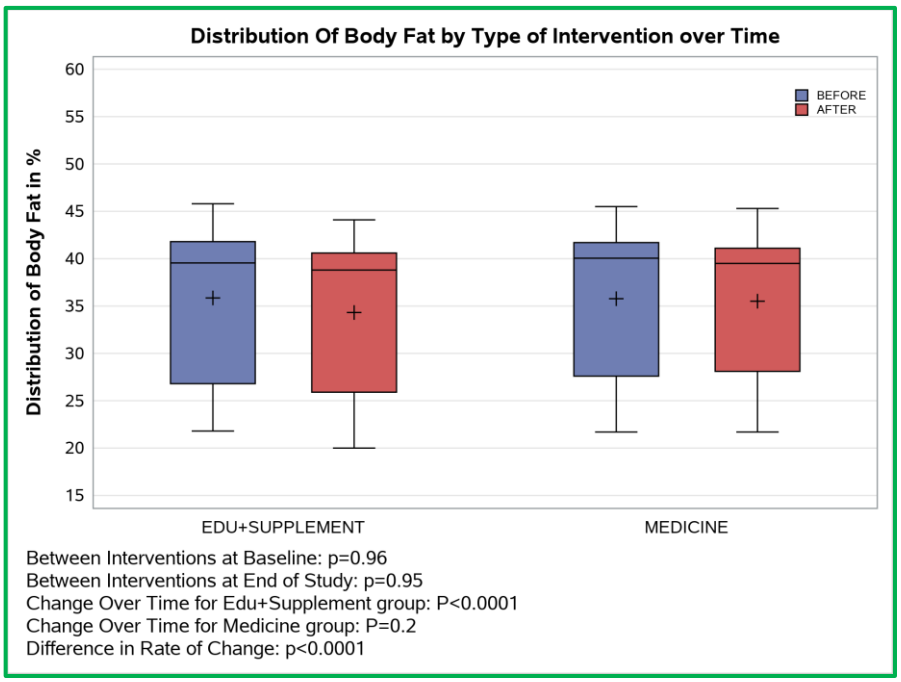

Figure 30 Comparison of Average body fat of the participants among study groups

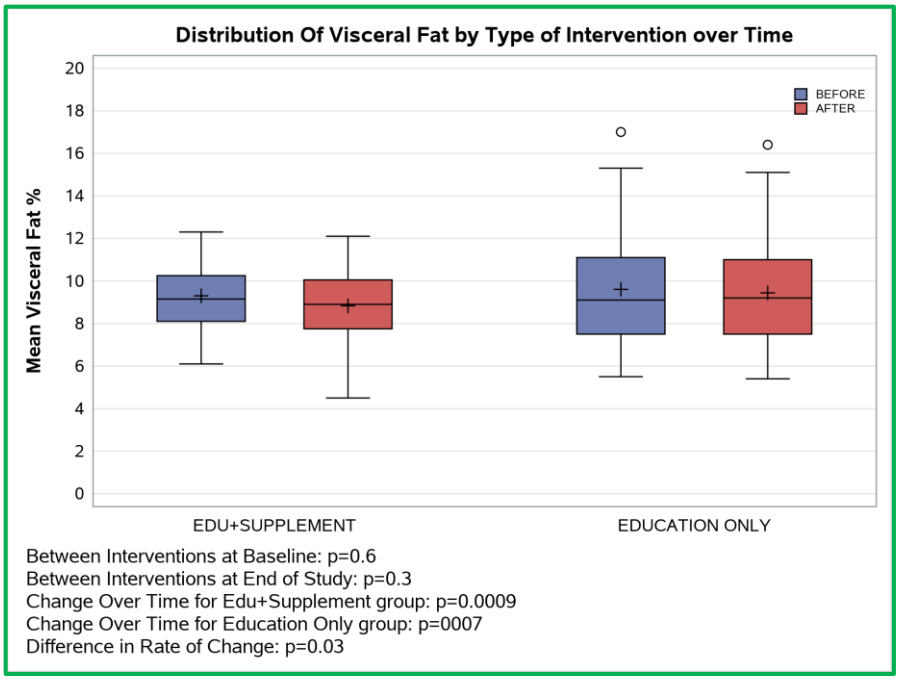

Figure 31 Comparison of mean visceral fat of the participants in the study group

xiii) Comparison of mean visceral fat of the participants in the Experimental group I and II

The mean visceral fat of the participants in the Experimental group I and II compared before and after intervention and is represented in Figure 31.At base line visceral fat was comparable (p=0.60).Between the interventions at the end of the study was not significant (p= 0.30).The change over time for Supplementation group and Education group was significant (p=0.000) .The difference in rate of change also significant (p=0.03)

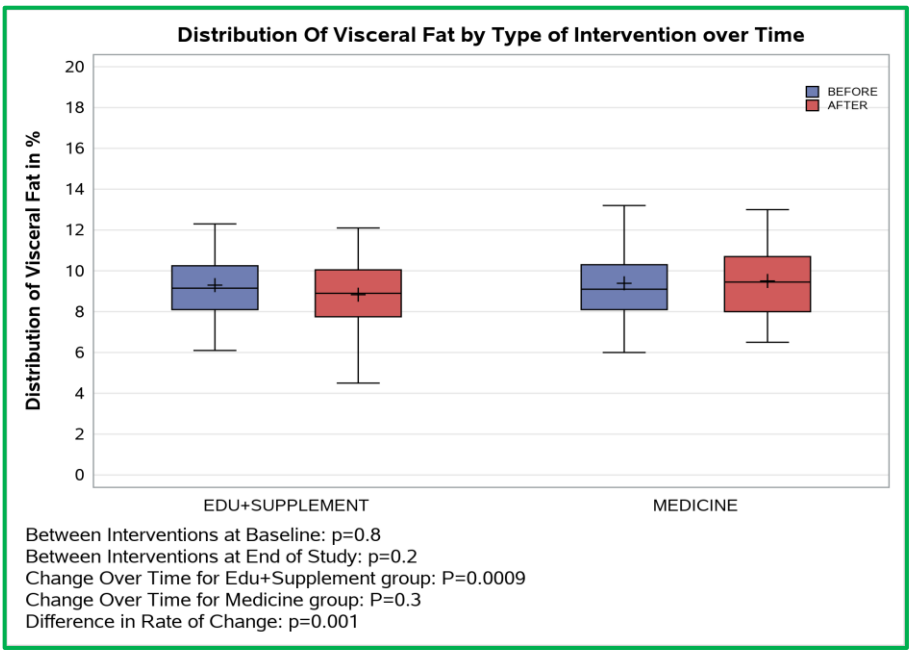

Figure 31Comparison of mean visceral fat of the participants in the study group

xiv) Comparison of mean visceral fat of the participants in the Experimental group I and Control group

Figure 31 is a representation of mean visceral fat of the participants in the Experimental group I and control group were compared before and after intervention .Before the intervention , visceral fat was comparable (p=0.80).Between the interventions at the end of the study was not significant (p= 0.20).The change over time for Experimental group I was significant (p=0.000) and control group was insignificant (p=0.30).The difference in rate of change also significant (p=0.001)

xv) Comparison of mean Haemoglobin of the participants in the study groups Experimental group I and II

Figure 32 represented the he mean haemoglobin of the participants in the Experimental group I and II compared before and after intervention .Before the beginning of the study haemoglobin was comparable (P=0.20).At the end of the study there was a significant difference between the mean values of haemoglobin between the interventions (p=0.04).The change over time for the Experimental group I and Experimental group II was not significant (p>0.05).The difference in rate of change was also not significant (p=0.80)

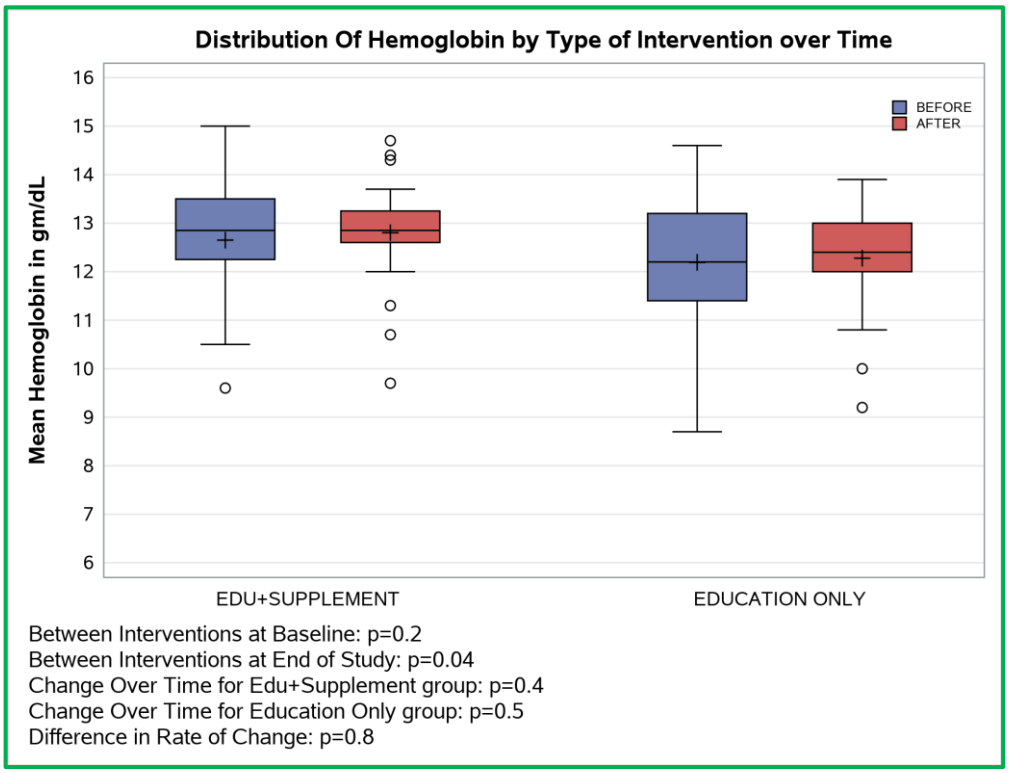

Figure 32 Comparison of mean Haemoglobin of the participants

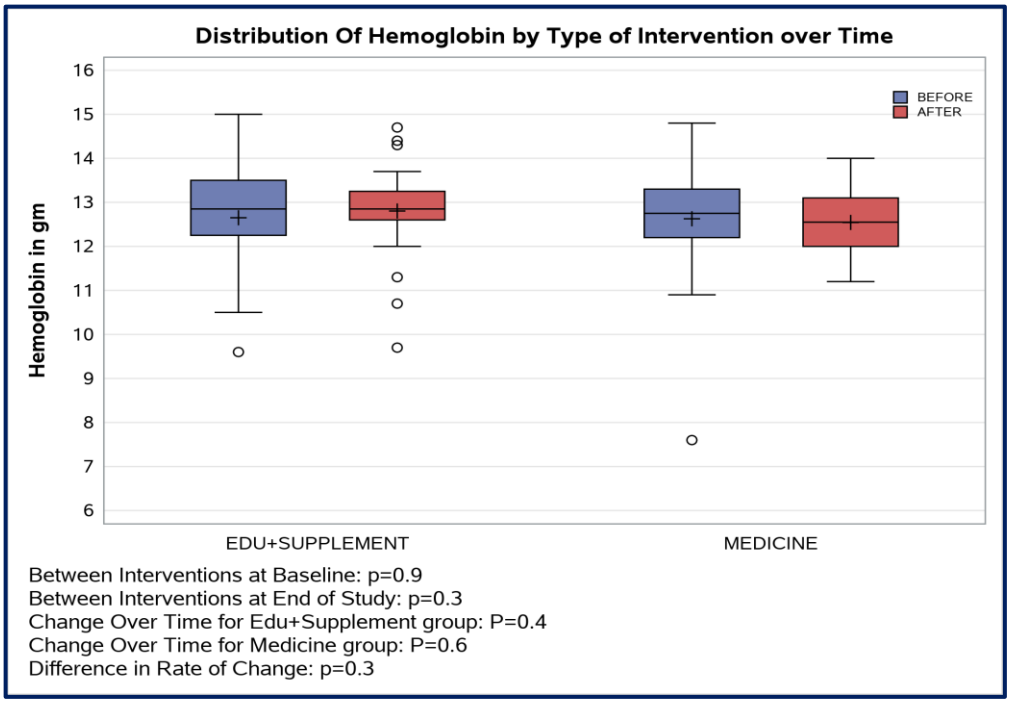

Figure 32 Comparison of mean Haemoglobin of the participants

xvi) Comparison of the mean Haemoglobin of the Participants in the Experimental I and Control groups

The mean haemoglobin of the participants in the Experimental group I and control group compared before and after intervention and is portrayed in figure 32.Before the start of the study , haemoglobin was comparable (P=0.90).At the end of the study there was no significant difference between the mean values of haemoglobin between the interventions (p=0.30).The change over time for the Experimental group I and control group was not significant (p>0.05).The difference in rate of change was also not significant (p=0.30)

xvii) Comparison of the mean Random blood sugar of the participants in the study groups Experimental I and II

The mean Random blood sugar of the participants in the Experimental group I and II compared before and after intervention and is given in Figure 33. random blood sugar was comparable (P=0.30)at the beginning .At the end of the study there was no significant difference between the mean cholesterol levels between the intervention groups (p= 0.20). The change over time for Experimental group I and II was not significant (p>0.05).The difference in rate of change was also not significant (p=0.9)

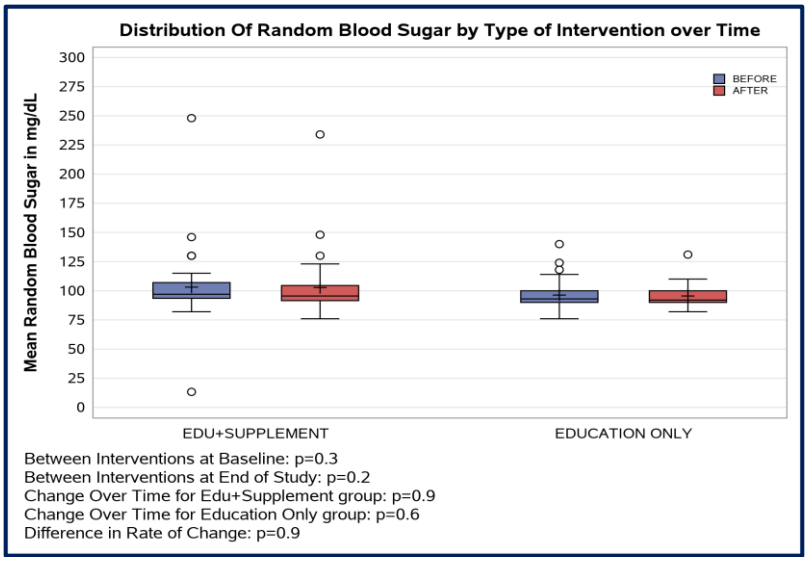

Figure 33 Comparison of mean random blood glucose of the study participants

xviii) Comparison of mean blood sugar of the participants in the study group Experimental I and II

The mean Random blood sugar of the participants in the Experimental group I and control compared before and after intervention and is indicated in Figure33. Random blood sugar values before the initiation of the study was comparable (P=0.80).At the end of the study there was no significant difference between the mean random blood sugar levels between the intervention groups (p= 0.70). The change over time for Experimental group I and control group was not significant (p>0.05).The difference in rate of change was also not significant (p=0.40)

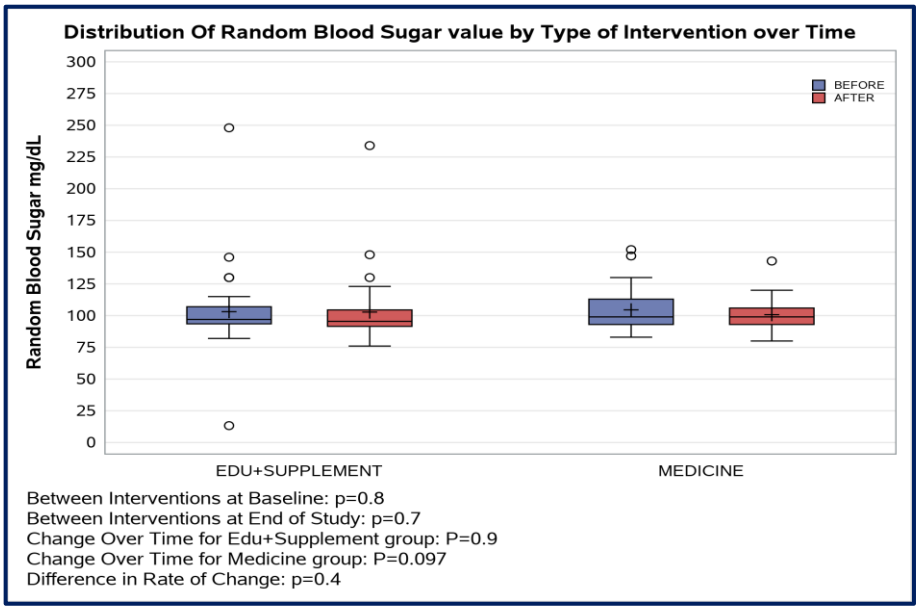

Figure 33 Comparison of mean random blood sugar of the participants

xix) Comparison of the Experimental group I and II participants mean Cholesterol levels

Figure 34 compares the mean cholesterol levels of the Experimental group I and II participants before and after the intervention. At the beginning, cholesterol levels were similar (P=0.20).At the conclusion of the trial, there was no statistically significant difference between the cholesterol mean values (p=0.80). For Experimental group I, the change over time was significant (p=0.03) while it was not for Experimental group II (p=0.50). It was determined that the difference in change rate was not significant (p=0.10).

xx) Comparison of mean Cholesterol of the participants in the Experimental group I and control group

Figure 34 also represents the mean cholesterol of the participants in the Experimental group I and control compared before and after intervention. In the beginning , cholesterol was comparable(P=0.30) .At the end of the study there was no significant difference between the mean values of Cholesterol (p=0.20). The change over time was statistically significant for Experimental group I and was insignificant for control group (p=0.50) The difference in rate of change was found to be insignificant (p=0.004)

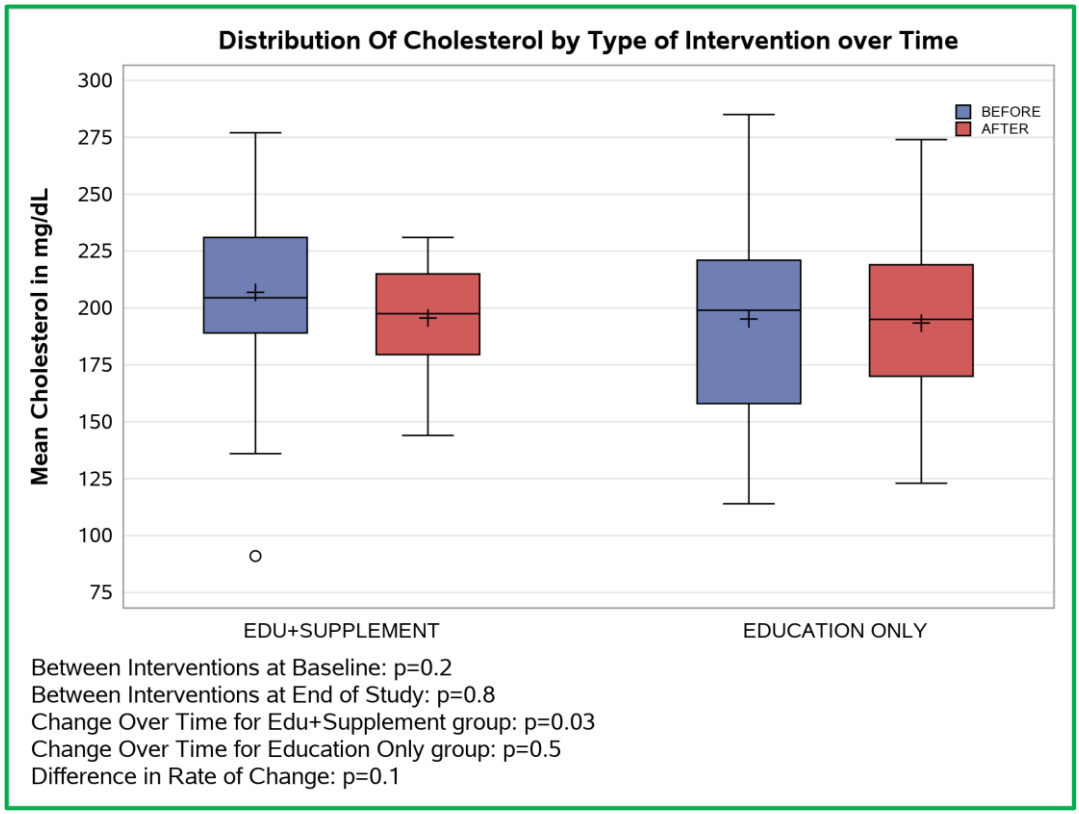

Figure 34 Comparison of mean Cholesterol level of the participants

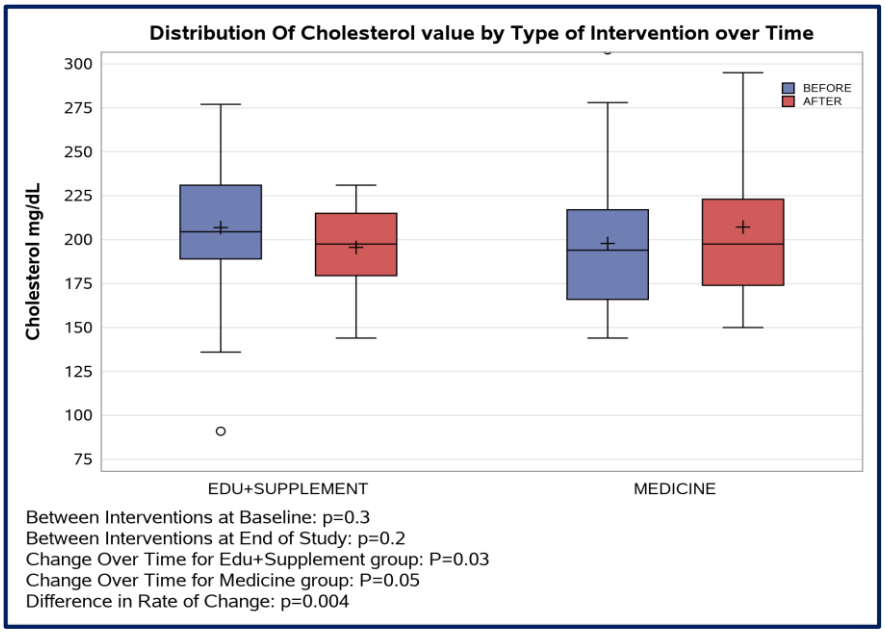

Figure 34 Comparison of mean Cholesterol level of the participants

xxi) A comparison of the Experimental group I and II participants mean triglycerides

Figure 35 compares the mean triglycerides of the Experimental group I and II participants before and after the intervention. Triglyceride was comparable at the baseline (P=0.50). There was no statistically significant difference between the mean values of triglycerides at the conclusion of the research (p=0.10). For Experimental group I, the change over time was significant (p<0.05), however for Experimental group II, it was not (p=0.50). It was determined that the difference in change rate was not significant (p>0.050**).**

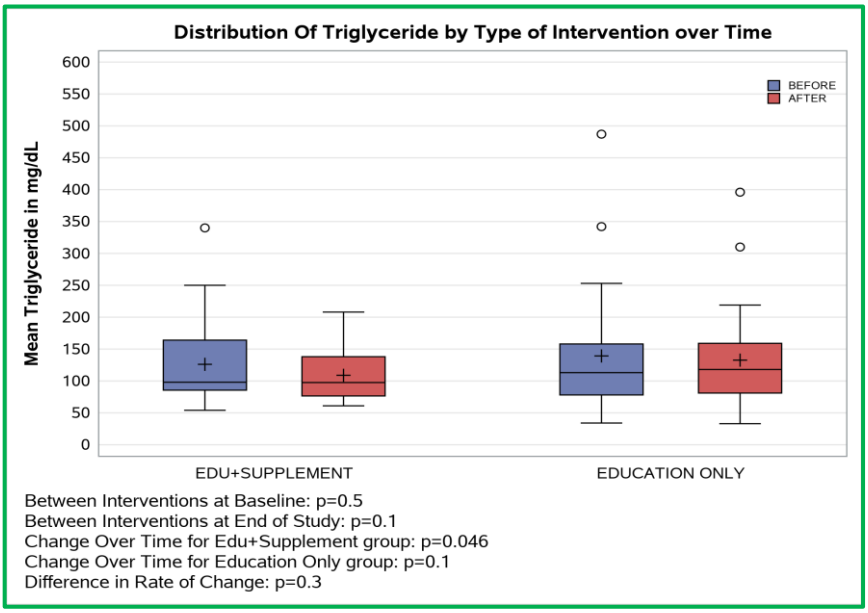

Figure 35 Comparison of mean Triglyceride level of the participants

xxii) Comparison of mean Triglycerides of the participants in the Experimental group I and Control group

Figure 35 denotes the mean Triglycerides of the participants in the Experimental group I and control group compared before and after intervention. Triglyceride was comparable (P=0.7 0) at the starting of the trial .There was a significant difference between the mean values of Triglycerides at the end of the study (p=0.04).The change over time was significant for Experimental group I (p<=0.046) and insignificant for control group (p= 0.40).The difference in rate of change was found to be insignificant (p=0.04)

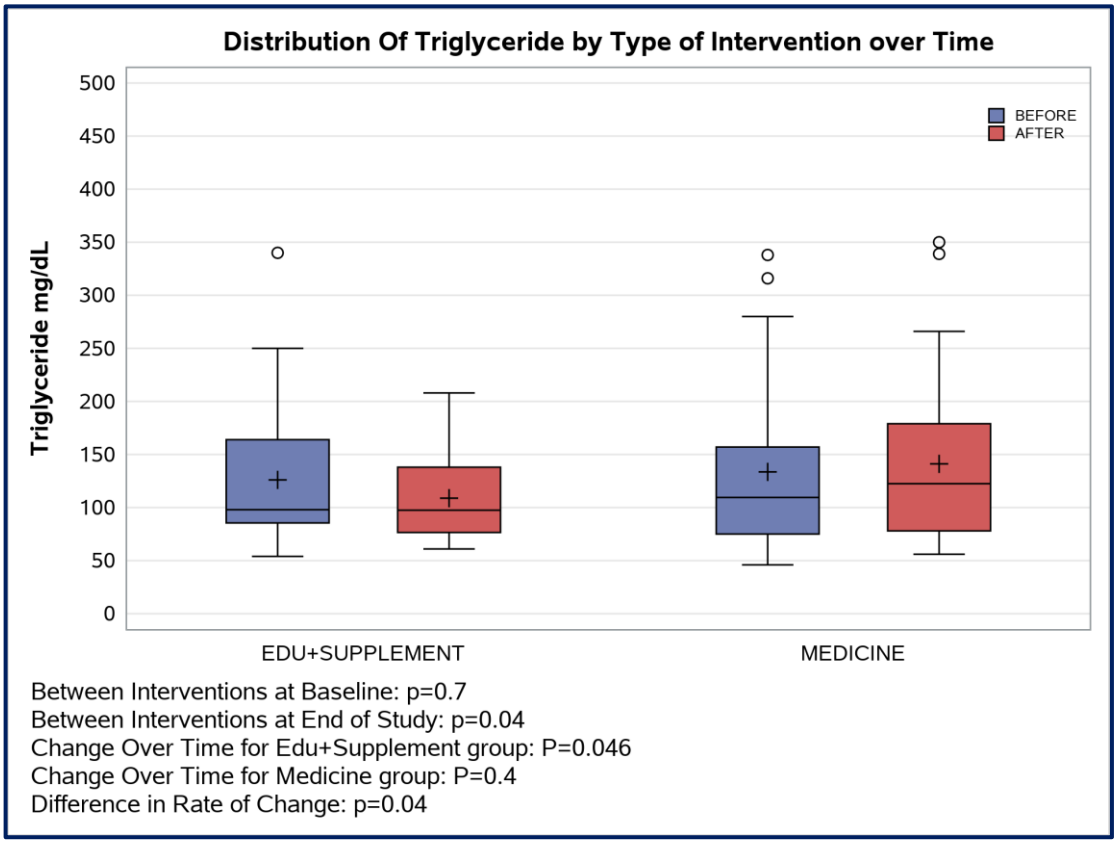

Figure 35 Comparison of mean Triglyceride level of the participants

xxiii) A comparison of the Experimental group I and II individuals mean High Density Lipoprotein(HDL) Levels

Figure 36 shows the mean High Density Lipoprotein levels of the Experimental group I and II participants before and after the intervention.HDL was comparable at the baseline (P=0.20).There was no statistically significant difference between the mean values of triglycerides at the conclusion of the research (p=0.20).For Experimental group I, the change over time was not significant (p=0.60), but for Experimental group II, it was (p=0.005).It was determined that the difference in change rate was negligible (p=0.70).

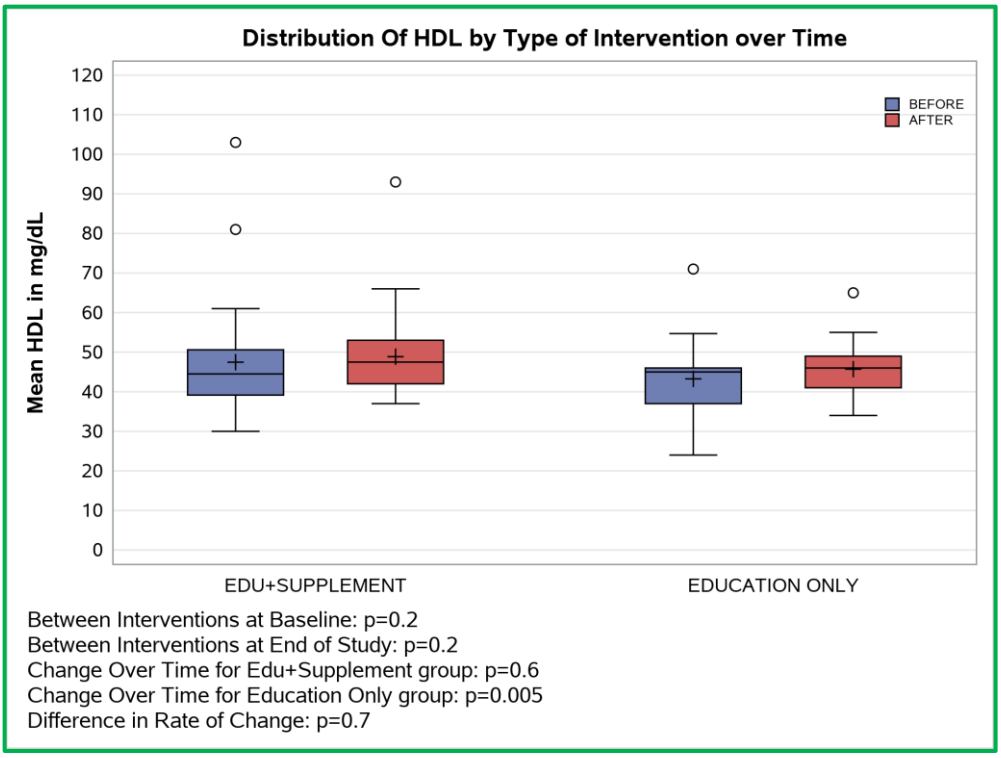

Figure 36 Comparison of Average HDL level of the participants

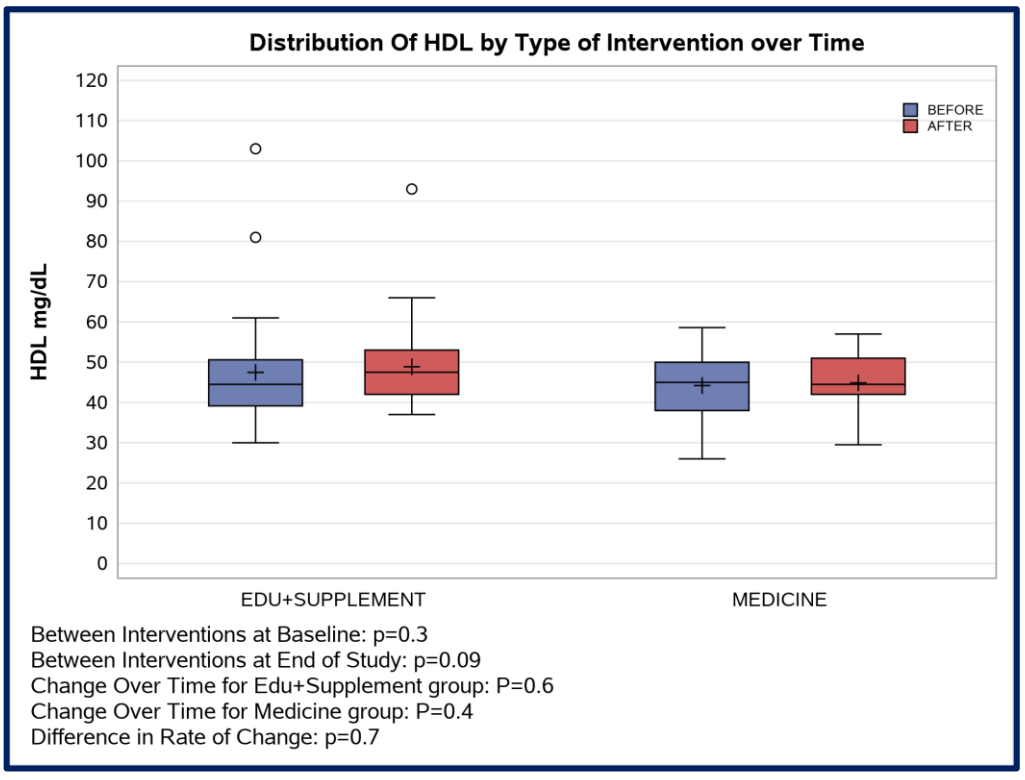

Figure 36 Comparison of Average HDL level of the participants

xxiv) Comparison of mean High Density Lipoprotein (HDL) of the participants in the Experimental group I and control group

The mean High Density Lipoprotein of the participants in the Experimental group I and control group compared before and after intervention and is depicted in figure 36.Before the beginning of the trial , HDL was comparable (P=0.30).At the end of the study there was no significant difference between the mean values of High Density Lipoprotein Cholesterol (p=0.09).The change over time was insignificant for both Experimental group I (p>0.05) and control group (p>0.05).The difference in rate of change was found to be insignificant (p=0.70)

xxv) Comparison of mean Low Density Lipoprotein (LDL) of the participants in the Experimental group I and II

The mean Low Density Lipoprotein of the participants in the Experimental group I and II compared before and after intervention and is represented in Figure37. At base line HDL was comparable (P=0.30).At the end of the study there was no significant difference between the mean values of Triglycerides (p=0.30).The change over time was insignificant for Experimental group I and II (p>0.05) and the difference in rate of change was also found to be insignificant (p=0.90)

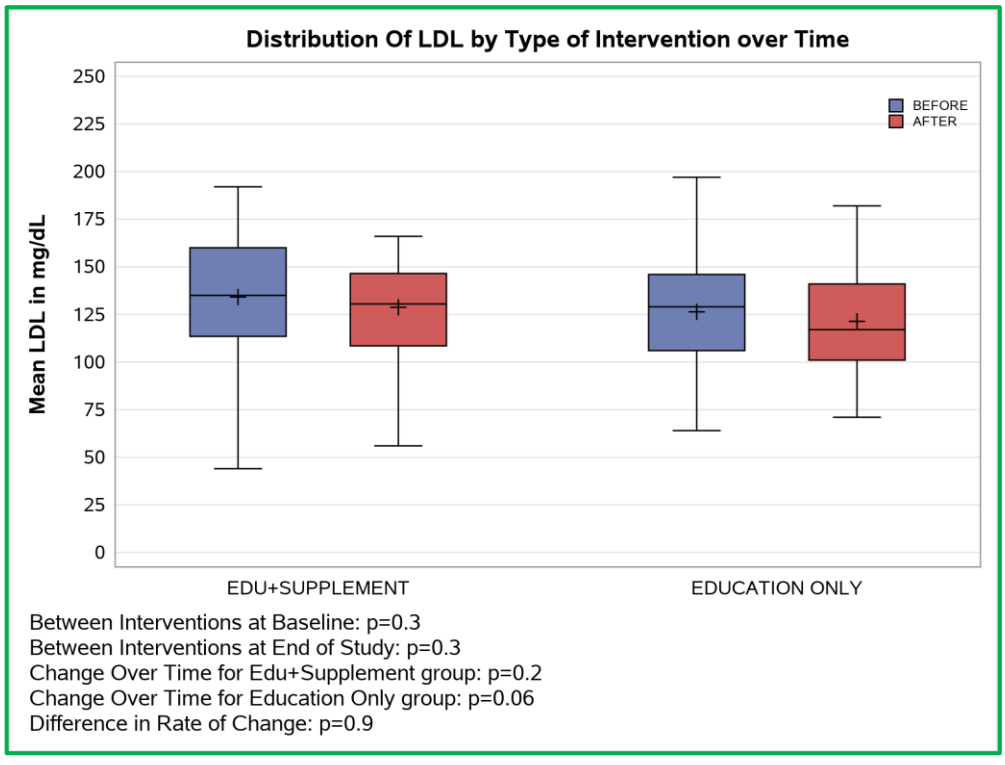

Figure 37 Comparison of mean LDL level of the participants

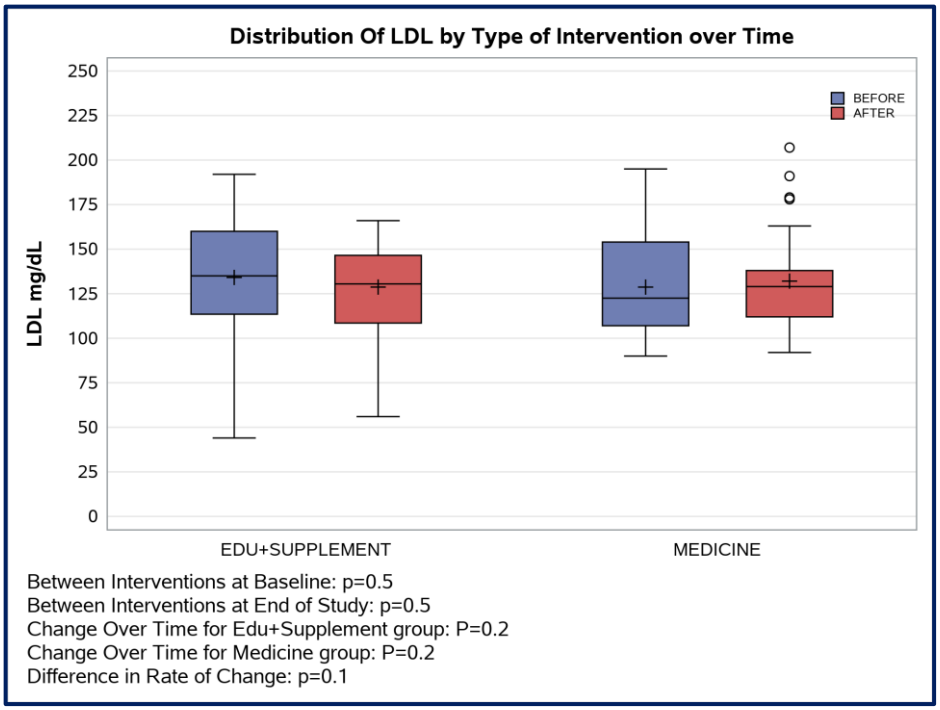

Figure 37 Comparison of mean LDL level of the participants

xxvi) Comparison of mean Low Density Lipoprotein (LDL) of the participants in the Experimental group I and Control group

The mean High Density Lipoprotein of the participants in the Experimental group I and II compared before and after intervention and is represented in Figure37. At base line LDL was comparable (P=0.50).At the end of the study there was no significant difference between the mean values of Triglycerides (p=0.30).The change over time was insignificant for Experimental group I and control group (p>0.05) and the difference in rate of change was also found to be insignificant (p=0.90)

xxvii) A comparison of the Experimental group I and II participants' mean cholesterol to HDL ratios

Figure 38 compares the mean Cholesterol to HDL Ratio of the Experimental group I and II participants before and after intervention. HDL was comparable at the baseline (P=0.40). There was no statistically significant difference between the mean values of the cholesterol to HDL ratio at the conclusion of the research (p=0.96). The difference in rate of change was similarly shown to be inconsequential (p=0.20), while the change over time was significant for Experimental group I (p=0.002) but insignificant for Experimental group II.

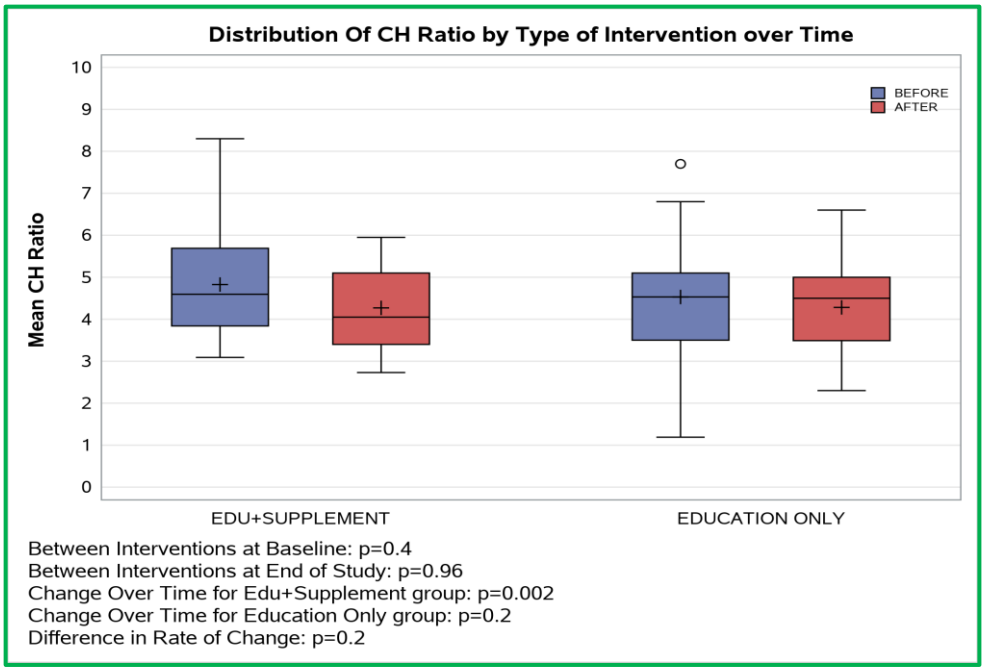

Figure 38 Comparison of Cholesterol to HDL ratio of the participants in the study groups

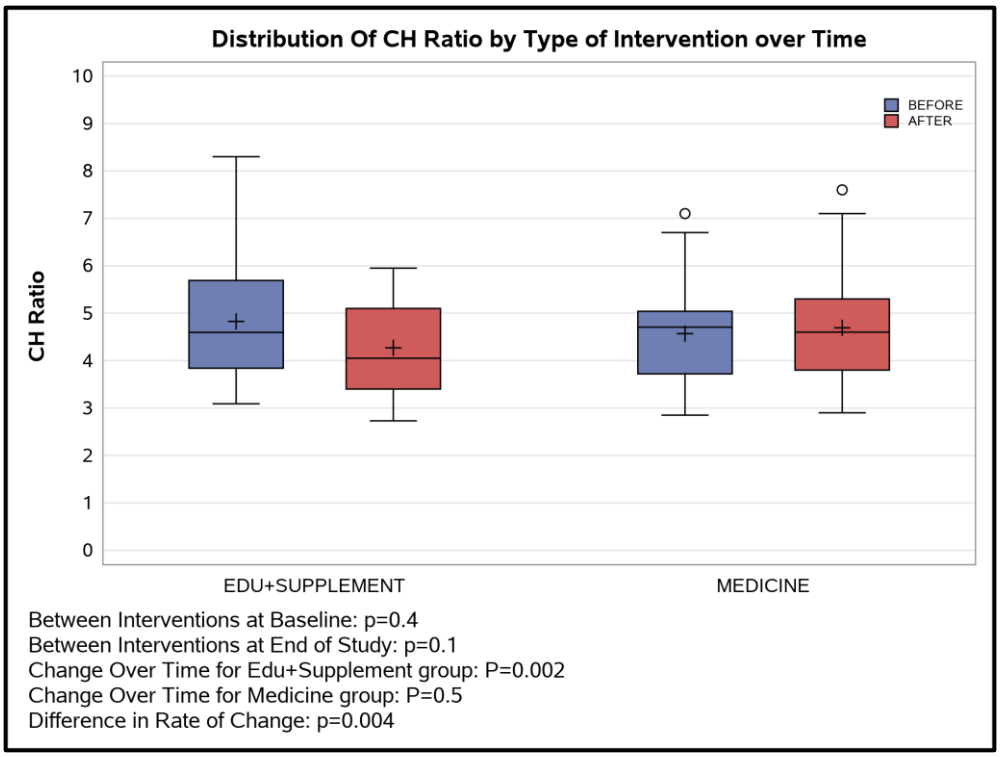

Figure 38 Comparison of Cholesterol to HDL ratio of the participants in the study groups

xxviii) Cholesterol to HDL ratio of the participants in the Experimental group I and control group

The mean Cholesterol to HDL Ratio of the participants in the Experimental group I and control group compared before and after intervention and is represented in figure38..At base line HDL was comparable (P=0.40).At the end of the study there was no significant difference between the mean values of Cholesterol to HDL ratio (p=0.10).The change over time was significant for Experimental group I (p=0.002) and insignificant for control group(p=0.50) and the difference in rate of change was also found to be significant (p=0.004).

xxix) A comparison of the experimental group I and II participants' mean testosterone levels

Figure 39 shows the mean testosterone levels of the Experimental group I and II participants before and after the intervention. Testosterone was comparable at the baseline (P=0.10).At the conclusion of the trial, there was no statistically significant difference between the testosterone mean values (p=0.97).The difference in rate of change was found to be significantly different (p=0.002) from the change over time for Experimental I group (p=0.002) and Experimental II group (p=0.80).

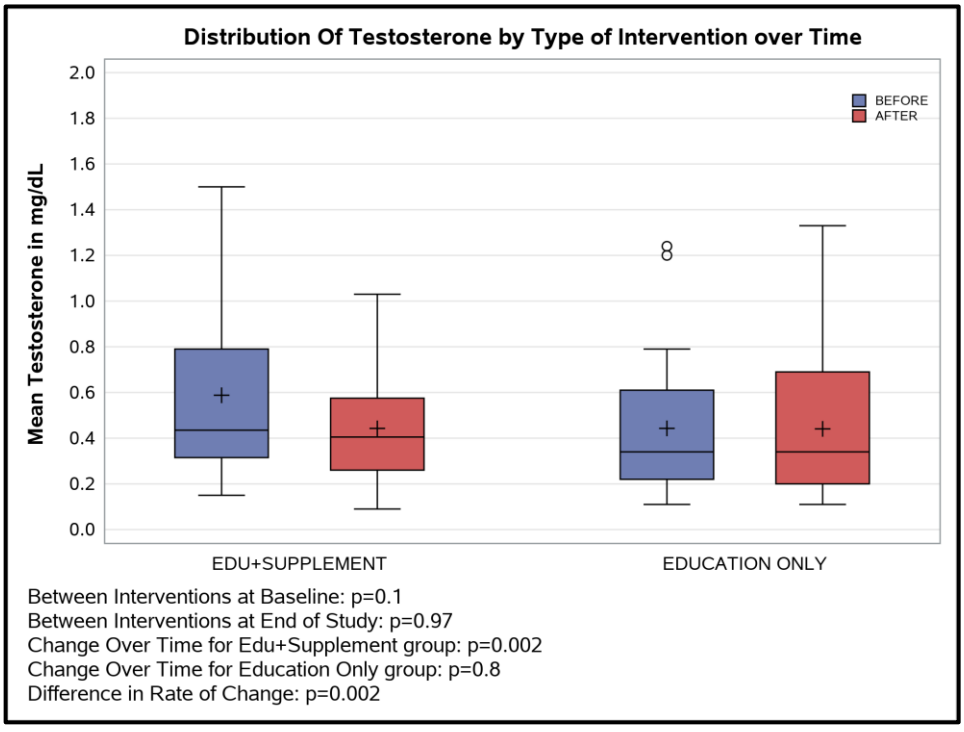

Figure 39 Comparison of Testosterone level of the participants

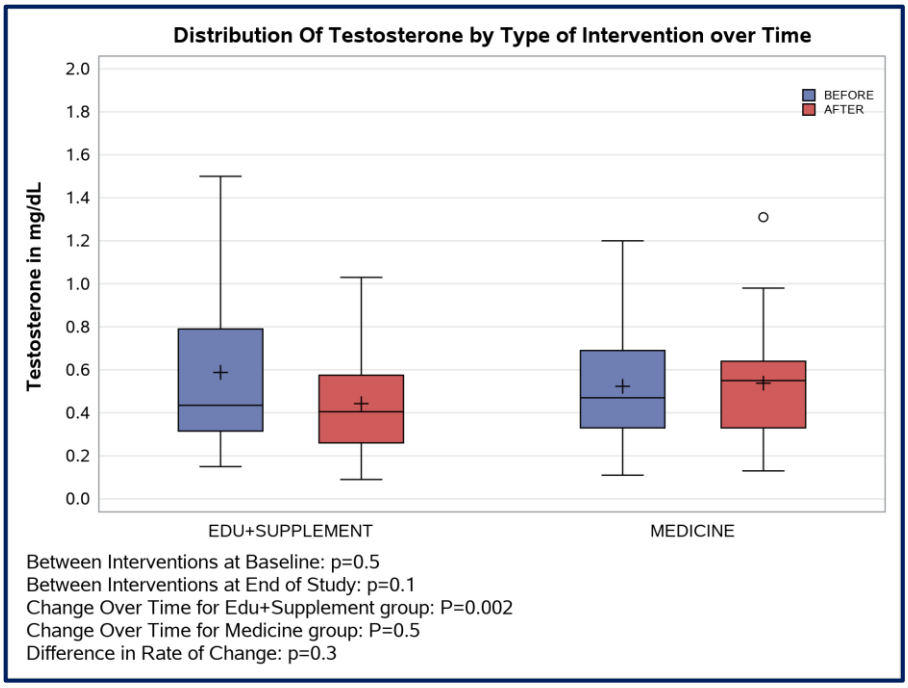

Figure 39 Comparison of Testosterone level of the participants

xxx) Comparison of mean Testosterone of the participants in the Experimental group I and control group

The mean Testosterone of the participants in the Experimental group I and control group before and after intervention and is represented in Figure39. At base line Testosterone was comparable (P=0.50).At the end of the study there was no significant difference between the mean values of Testosterone (p=0.10). The change over time was significant for Experimental group I (p=0.002) and was insignificant for control group (p=0.50) and the difference in rate of change was found to be insignificant (p=0.30)

xxxi) A comparison of the Experimental group I participants mean Hirsutism scores with Experimental group II

Figure 40 shows the mean Hirsutism score of the “Experimental group I and II “participants before and after the intervention. Hirsutism score was comparable at the baseline (P=0.70). There was no statistically significant difference in the mean levels of hirsutism at the conclusion of the trial (p=0.70). For Experimental group I and the control group, the change over time was not statistically significant (p>0.05), and the difference in change rate was likewise not statistically significant (p=0.40).

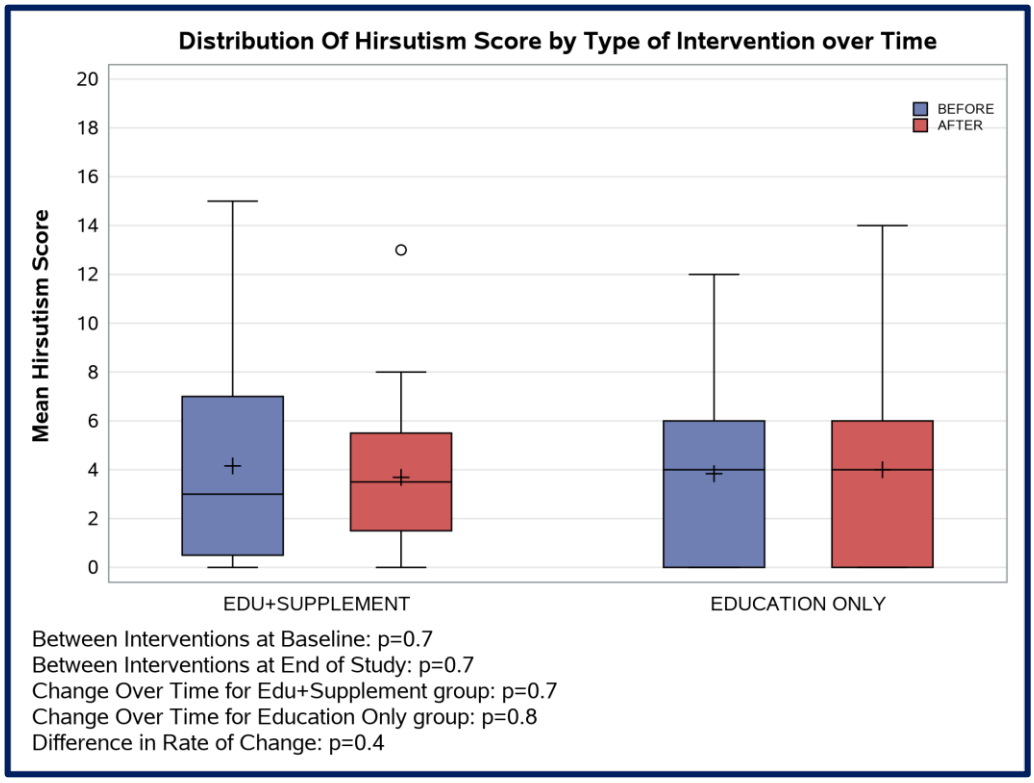

Figure 40 Comparison of Hirsutism score of the participants

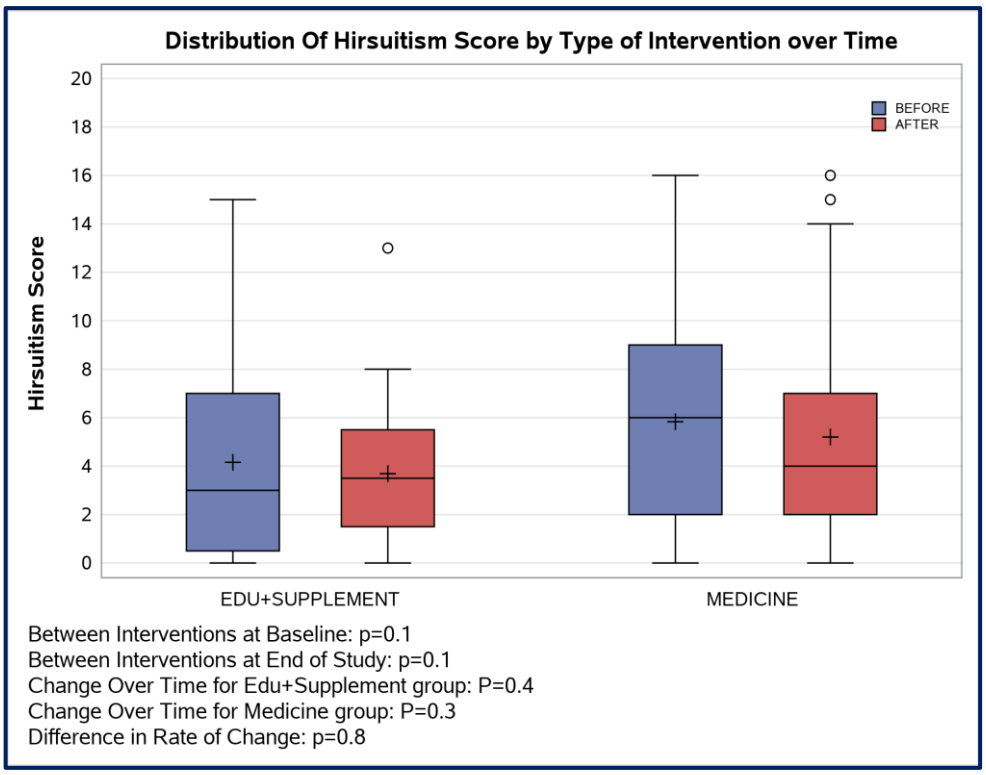

Figure 40 Comparison of Hirsutism score of the participants

xxxii) A comparison of the Experimental group the Experimental group I participants mean Hirsutism scores with those of the control group

Figure 40 shows the mean Hirsutism score of the Experimental group I control group individuals compared before and after intervention. Hirsutism score was identical at the baseline (P=0.10). There was no statistically significant difference in the Hirsutism mean values at the conclusion of the trial (p=0.10). For Experimental group I and the control group, the change over time was not statistically significant (p>0.50), and the difference in change rate was likewise not statistically significant (p=0.80).

xxxiv)A comparison of the participant's mean acne scores between Experimental group I and the Experimental group II

Figure 41 compares the mean Acne score of the Experimental group I and II participants before and after the intervention. Acne score was comparable at the baseline (P=0.80). There was no statistically significant difference between the Acne mean values at the conclusion of the trial (p=0.96). The difference in rate of change was similarly found to be not significant (p=0.20), and the change over time was significant for Experimental group I (p=0.03) but not for Experimental group II (p=0.80).

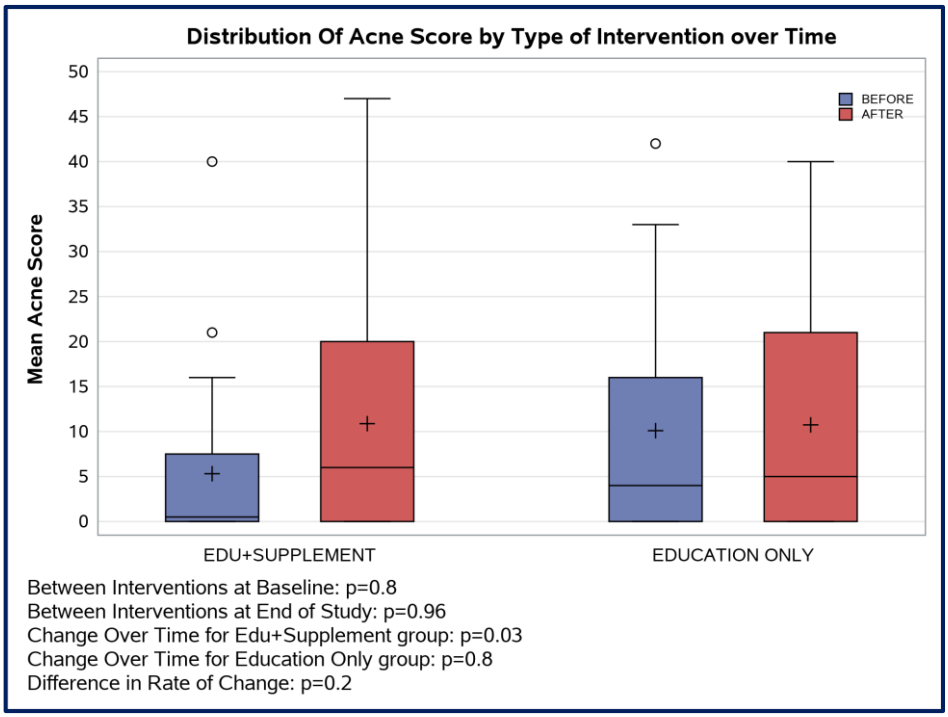

Figure 41 Comparison of Acne score of the participants

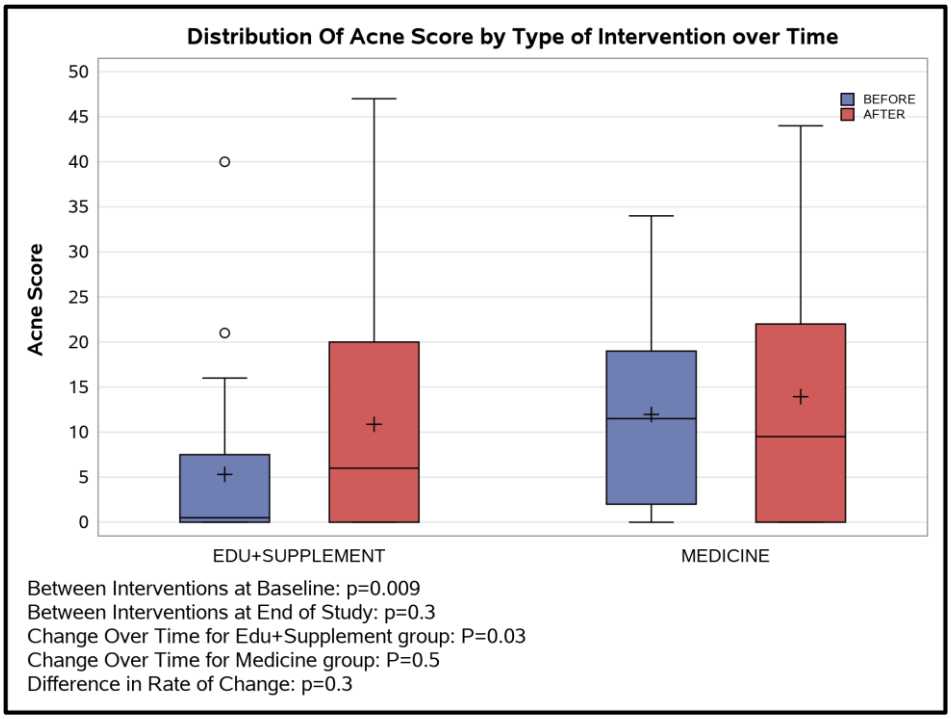

Figure 41 Comparison of Acne score of the participants

xxxiv) Comparison of mean acne scores of the participants in the Experimental group I and control group

The mean Acne score of the participants in the Experimental group I and control group compared before and after intervention and is represented in Figure 41. At base line Hirsutism score was comparable (P=0.80).At the end of the study there was no significant difference between the mean values of Hirsutism (p=0.30).The change over time was significant for Experimental group I(p=0.03) and was not significant for control group (p=0.50) and the difference in rate of change was also found to be not significant (p=0.30)

B) Proportion with high level of symptoms by type of intervention over time

i) Proportion with high Waist Hip Ratio by type of intervention over time for Experimental group I and Experimental group II

Kappa was used to study the change as the opposite agreement since other statistics like Mc Nemar's odds ratio would require that both women with lower waist hip ratio and higher waist hip ratio can change status to higher and lower respectively . That is women who had lower waist hip ratio must have the capacity to become higher after the intervention, while using Kappa those on lower waist hip ratio assumed to be lower even after the intervention.Figure 42 showed that before the intervention, there was no discernible difference in the per centage of high Waist Hip Ratio between Experimental Group II (Education Alone) and Group I (Education + Supplement). OR (95per cent Cl): 0.2

(0.02-2.1).Between the interventions at the end of the study, there was a no significant decrease in the between the groups. The kappa of agreement over time for Experimental group I showed that the per cent of women who have remained with high Waist Hip Ratio after the intervention was moderate. The change over time was high for Experimental group I as can be seen by moderate agreement Kappa 0.5 (-0.006-0.8), whereas the Experimental group II everyone remained the same as there was no change over time and Kappa was 1(1.0-1.0) and the test of equality of kappa was not applicable in this case.

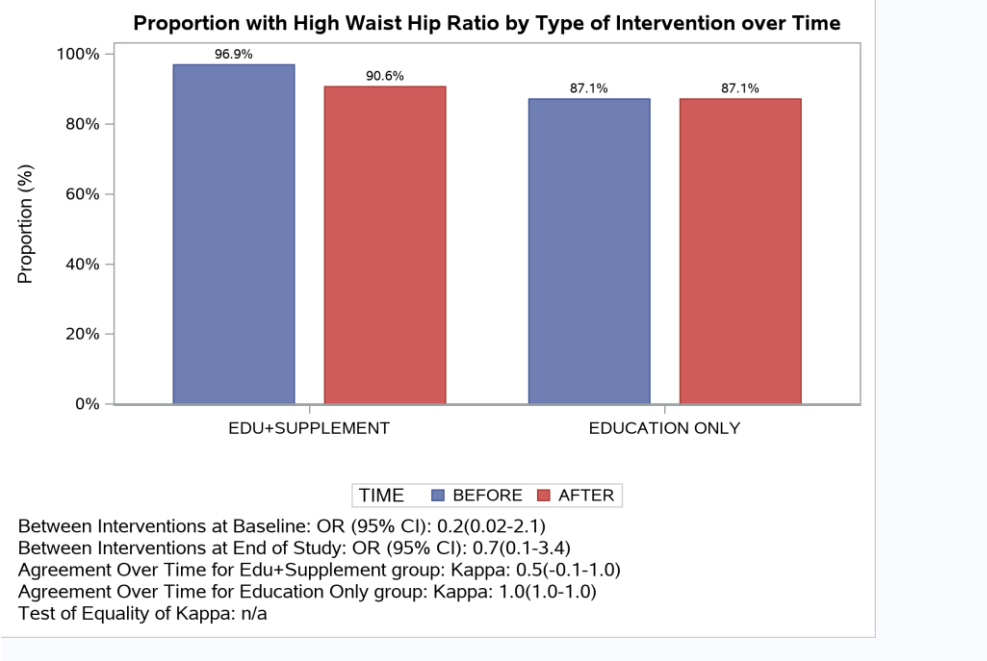

Figure 42 Proportion with high Waist Hip Ratio by type of intervention over time

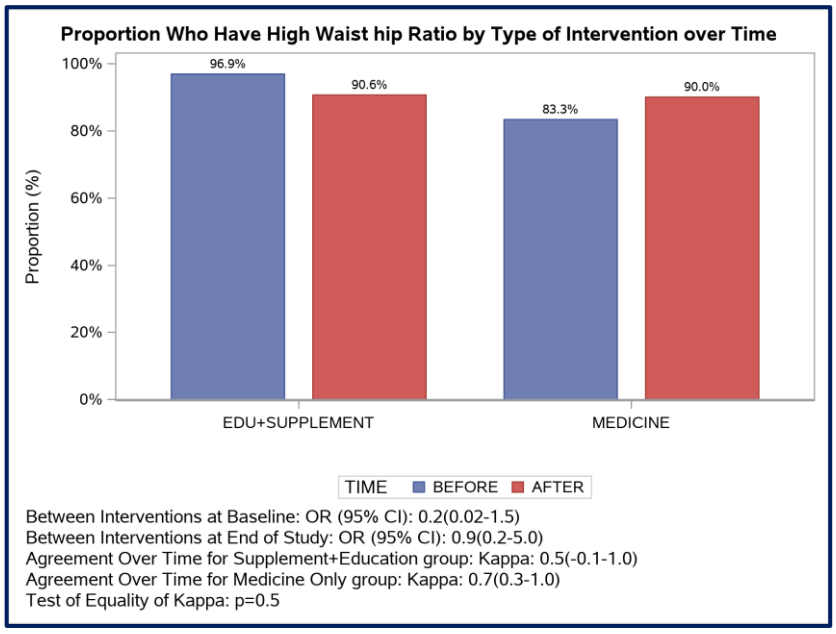

Figure 42 Proportion with high Waist Hip Ratio by type of intervention

ii) Proportion with high Waist Hip Ratio of intervention overtime for Experimental group I and Control group

Figure 42 indicated that there was no substantial difference with proportion of high WHR between the group I (Education+ supplement) and control group (Medication alone) before the intervention OR (95per cent Cl): 0.2(0.02-1.5). Between the interventions at the end of the study, there was no significant decrease of waist hip ratio between the groups. The kappa of agreement over time for Experimental group I showed that the per cent of women who have remained with high Waist Hip Ratio after the intervention was mild. The change over time was high for Experimental group I as can be seen by moderate agreement Kappa of 0.5 (-0.006-0.8), whereas the control group has shown a substantial agreement and Kappa was 0.7(0.3-1.0)everyone remained the same as there was no change over time and Kappa was 1(1.0-1.0) and the test of equality of kappa was not applicable in this case.

iii) Proportion with irregular menstrual cycles by type of intervention over time for Nutrition supplementation +Education and Nutrition Education group alone

Kappa was used to study the change as the opposite agreement since other statistics like Mc Nemar's odds ratio would require that both women with regular and irregular cycles can change status to irregular and regular respectively. That is women who had regular cycles must have the capacity to become irregular after the intervention, while using Kappa those on regular cycles always assumed to be regular even after the intervention. Figure 43 indicated that, there was no significant difference in menstrual irregularity between the group I (Education+ supplement) and group II (Education alone) before the intervention OR (95per cent Cl): 1.2(0.3-4.4). After the intervention, there was a significant reduction of (9.1 times) menstrual irregularity in the "Experimental group I" compared to the "Experimental group II." The kappa of agreement overtime for Experimental group I showed that the per cent of women who have remained with irregular menstrual cycles after the intervention was very few. The change over time was substantial for Experimental group I as can be seen by a very low Kappa of 0.1 (-0.005-0.2).However the Experimental group II the change over time is moderate Kappa 0.6(0.3-0.9). The change seen over time for the two groups are found to be significantly different.(p=0.004).

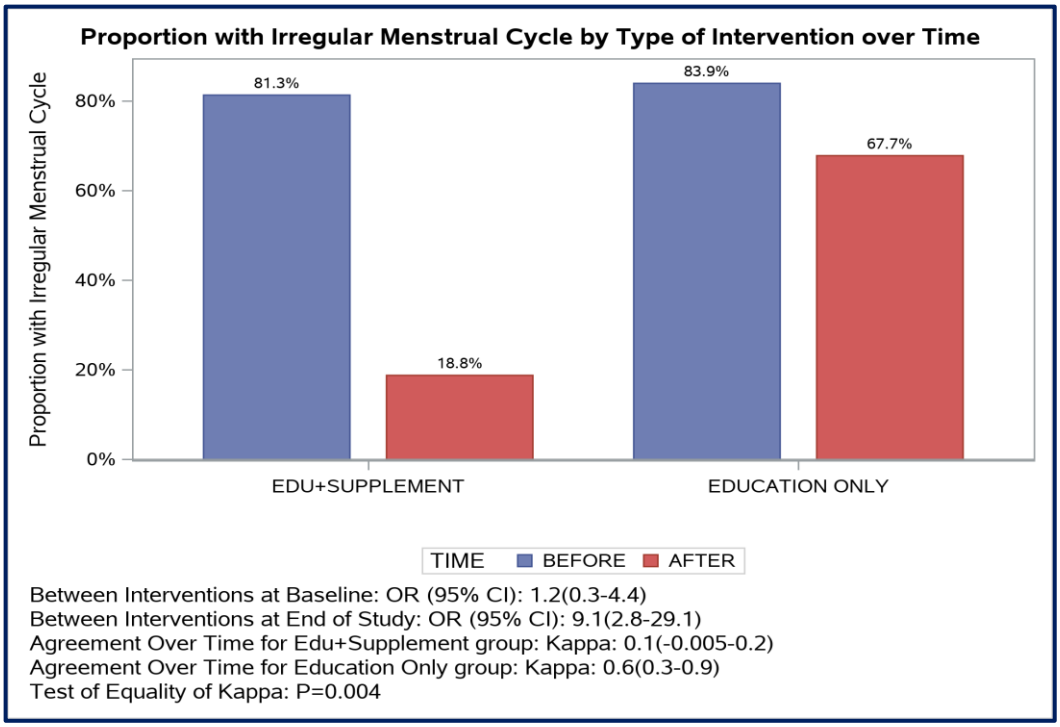

Figure 43 Proportion with Irregular Menstrual cycle by Type of Intervention over the study time

iv) Proportion with irregular menstrual cycles by type of intervention over time for Nutrition Supplementation +Education group and Nutrition Education group alone

Figure 43 confirms that there was no major difference in menstrual irregularity between the group I (Education+ supplement) and control group (Medication alone) before the intervention OR (95per cent Cl): 1.5(0.4-5.9). After the intervention, there was a significant reduction of (4.3 times) menstrual irregularity in the Supplementation group compared to the Education group .The kappa of agreement overtime for Supplement group I showed that the per cent of women who have remained with irregular menstrual cycles after the intervention was very few. The change over time minimal for Experimental group I as can be seen by a slight agreement Kappa of 0.1 (-0.005-0.2).However the control group the change over time is fair Kappa 0.3(0.03-0.5). The change seen over time for the two groups are not suggestively different. (p=0.2)

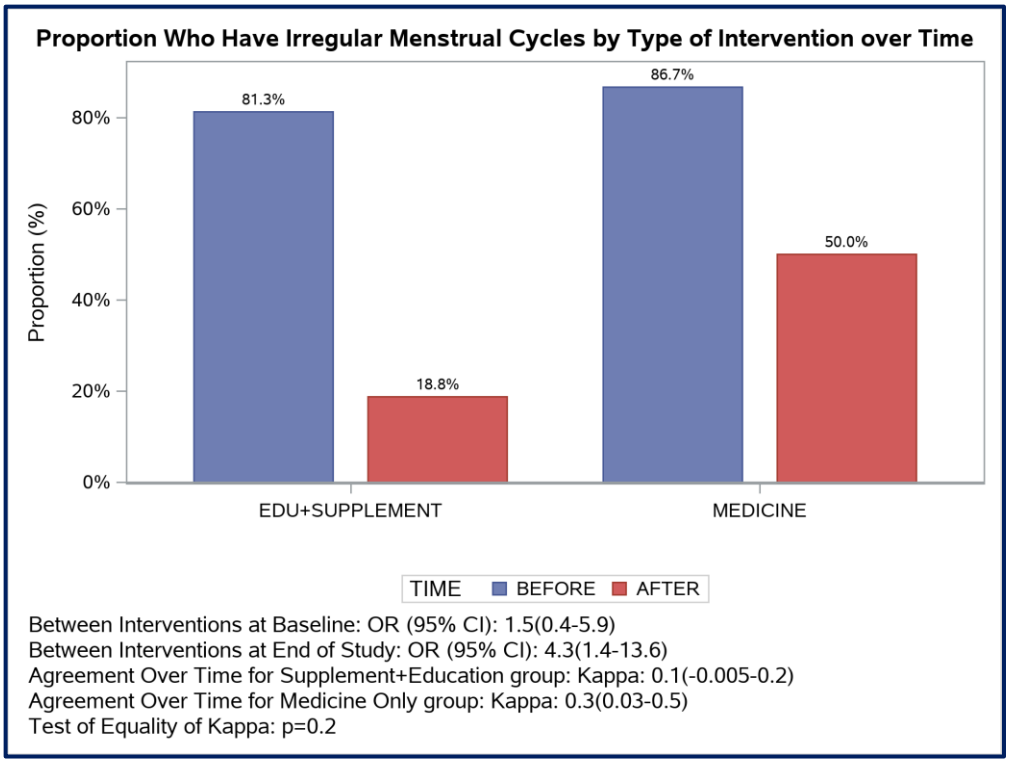

Figure 43 Proportion with Irregular Menstrual cycle by Type of Intervention over the study time

v) Proportion with high testosterone level in Experimental group I and Experimental group II by type of intervention over the study time

Figure 44 indicated that there was no significant difference in the proportion of high levels of testosterone between the group I (Education+ supplement) and Experimental group II (Education alone) before the intervention OR (95per cent CI):0.8(0.3-2.3). After the intervention also, there was no significant decrease of high testosterone value between the groups. The kappa of agreement overtime for Experimental group I showed that the proportion of women who have remained with high testosterone levels after the intervention was moderate. The change over time was high for Experimental group I as can be seen by moderate agreement Kappa of 0.7 (-0.4-0.96).Whereas the Experimental group II everyone remained the same as there was no change over time and Kappa was 1(1.0-1.0) and the test of equality of kappa was not applicable in this case.

vi) Proportion who had high testosterone value by type of intervention overtime for Experimental group I and Control group

Figure 44 indicates considerable difference in the proportion of high levels of testosterone between the group I (Education+ supplement) and Control group (Medication alone) before the intervention OR (95per cent CI): 1.1(0.4-3.1). After the intervention also,

there was no significant decrease of high testosterone value between the groups.The kappa of agreement overtime for Experimental group I showed that the per cent of women who have remained with high testosterone levels after the intervention was substantial. The change over time was high for Experimental group I as can be seen by substantial agreement Kappa of 0.7 (-0.4-0.96).Similarly the Control group the change over time was also substantial Kappa: 0.8(0.5-1.0). The change seen over time for the two groups are not significantly different (p=0.6).

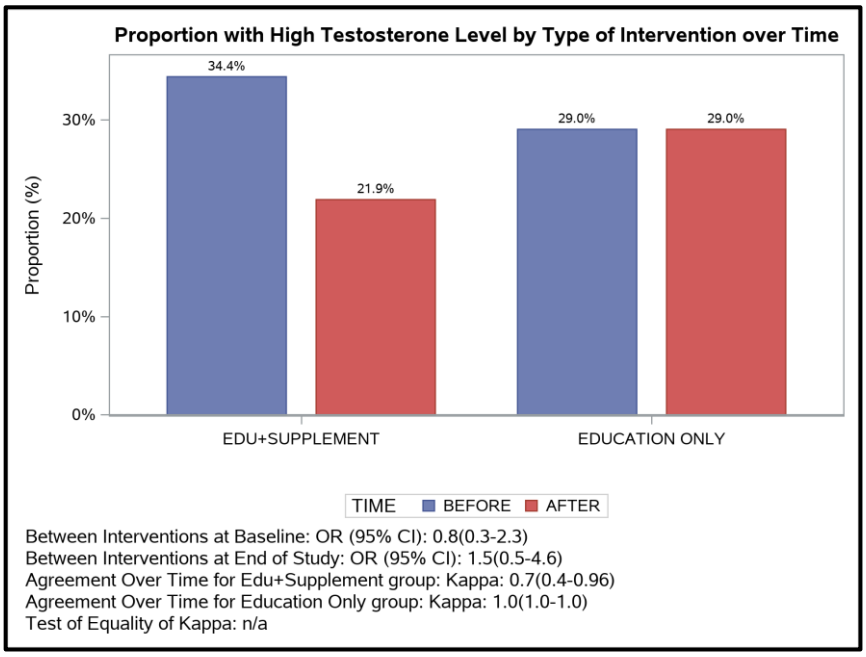

Figure 44 Proportion with High testosterone by type of Intervention over study time

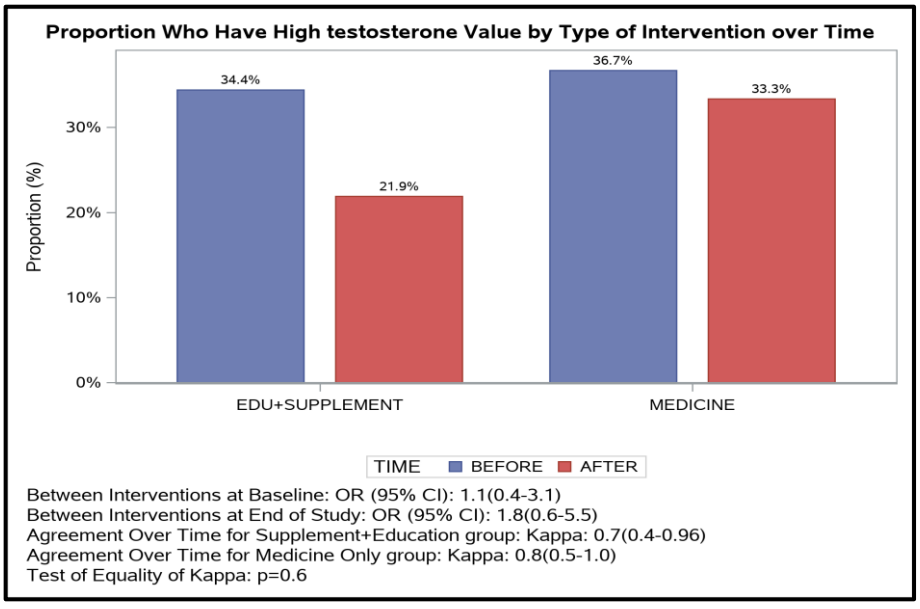

Figure 44 **Proportion with High testosterone by type of Intervention over study time**

viii) Proportion with high Hirsutism scores Experimental group I and Experimental group II by type of intervention over time

In Figure 45 there was no significant difference in the proportion of high hirsutism scores between the group I (Education+ supplement) and group II (Education alone) before the intervention OR (95per cent CI): 0.7(0.2-2.4). Between the interventions at the end of the study, there was no significant decrease of high testosterone value between the groups. The kappa of agreement over time for Experimental group I showed that the per cent of women who have remained with high hirsutism scores after the intervention was fair. The change over time was high for Experimental group I as can be seen by fair agreement Kappa of 0.4 (-0.006-0.8).Similarly the Experimental group II the change over time was moderate Kappa: 0.6(0.2-1.0) .The change seen over time for the two groups are not differed significantly (p=0.40).

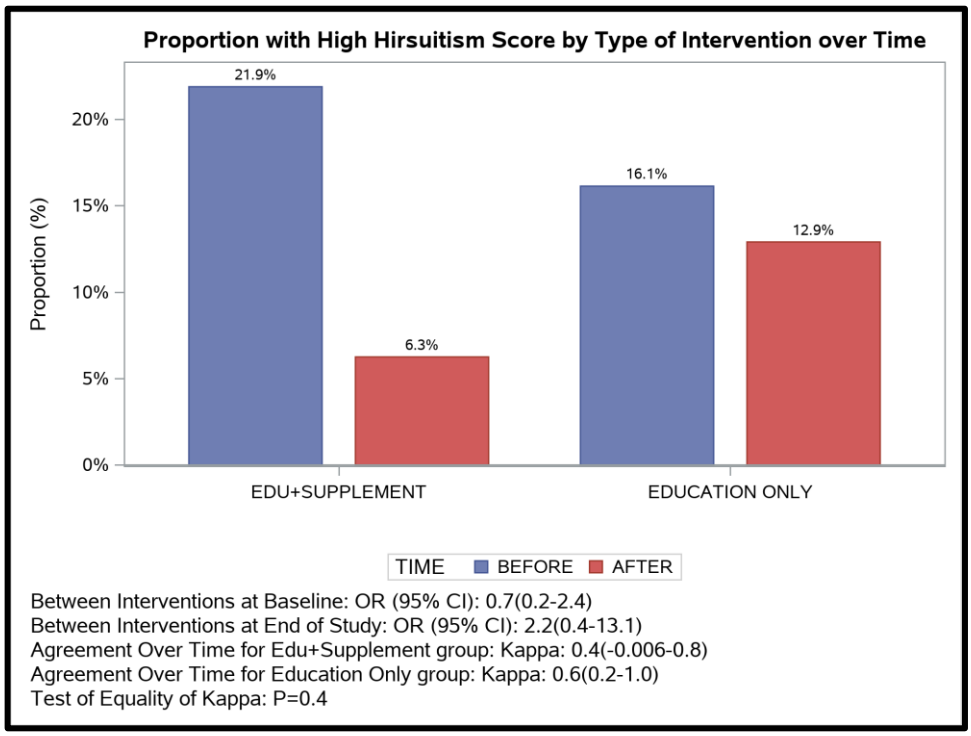

Figure 45 Proportion with High Hirsutism Score by type of Intervention over time

viii) The per cent of Experimental group I and Control group members having high Hirsutism scores over time, broken down by the method of intervention.

Before the intervention, the proportion of high hirsutism scores between the group I (Education+ supplement) and Control group (Medication alone) did not change significantly, according to Figure 43 OR (95per cent CI): 2.1. (0.7-6.3). At the conclusion of the trial, there was a significant reduction in hirsutism scores between the groups between

the interventions. The per cent of women who had high hirsutism scores after the intervention was mild, according to the kappa of agreement over time for Experimental group I. A fair agreement Kappa of 0.4 indicates that Experimental group I had a significant shift over time (-0.006-0.8).Similarly the control group the change over time was shown moderate agreement, Kappa: 0.5(0.2-0.80) .The change seen over time for the two groups are not significantly different.(p=0.60).

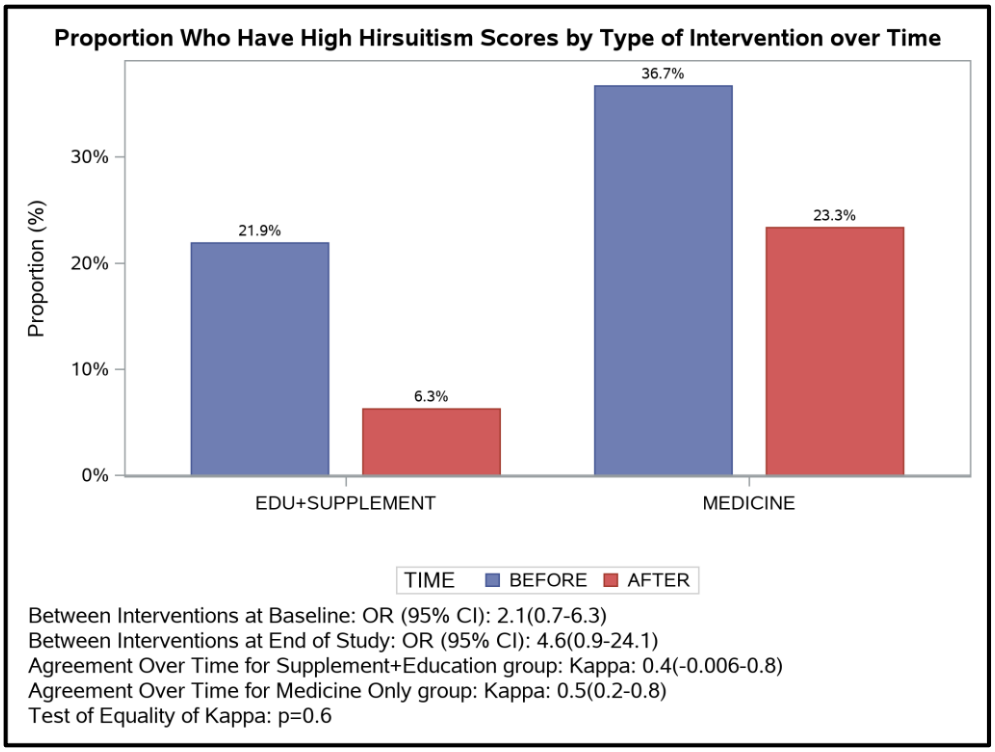

Figure 45 Proportion with High Hirsutism Score by type of Intervention over time

ix) Proportion with high Acne by type of intervention over time for Experimental group I and Experimental group II

Figure 46 indicated that there was no significant difference in the proportion of high Acne score between the group I (Education+ supplement) and Experimental group II (Education alone) before the intervention OR (95per cent Cl): 4.4(0.8-23.0). Between the interventions at the end of the study, the change was not significant in the acne, score between the groups. The kappa of agreement over time for Experimental group I showed that the proportion of women who have remained with high Waist Hip Ratio after the intervention was mild. The change over time was high for Experimental group I as can be seen by slight agreement Kappa of 0.2 (0.05-0.5), similarly in the experimental group II the change over time was shown fair agreement, Kappa: 0.3 (0.04-0.70) .The change seen over time for the two groups are not significantly different. (p=0.60).

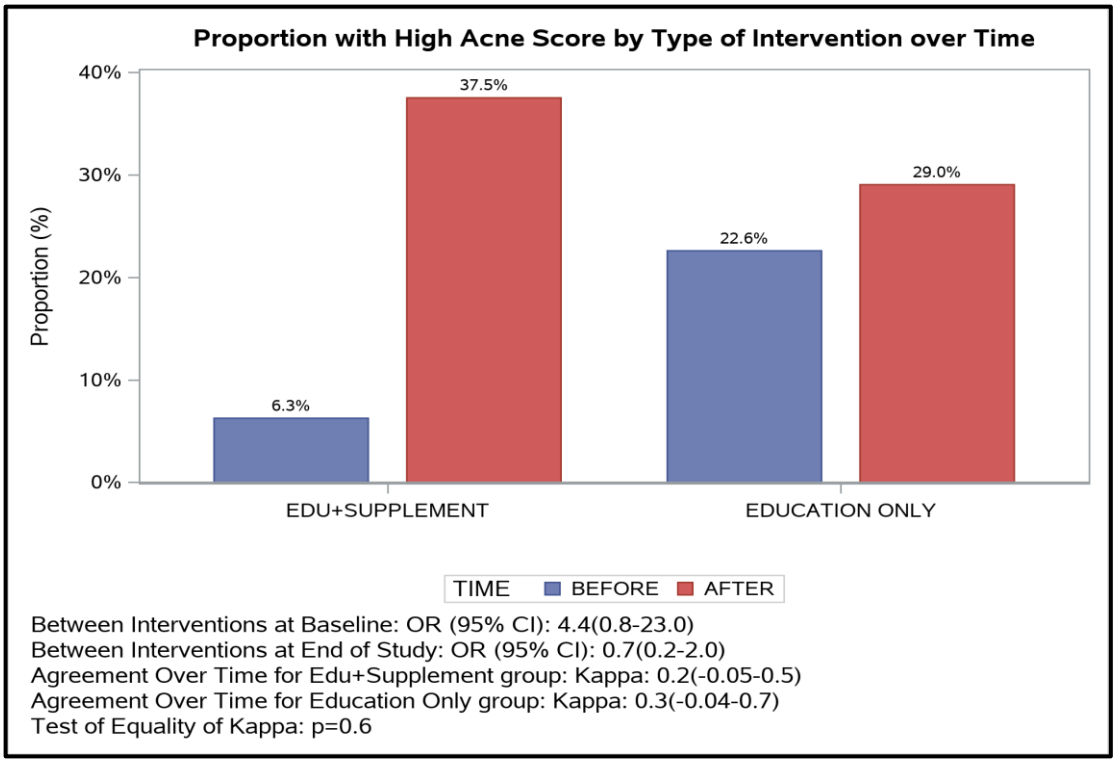

Figure 46 Proportion with High acne score by type of Intervention over time

x) Proportion with high Acne by type of intervention over time for Experimental group I and Control group

Figure 46 shows a striking difference in the proportion to high Acne score between the group I (Education+ supplement) and Control group (Medication alone) before the intervention OR (95per cent CI): 7.5(1.5-37.9). Between the interventions at the end of the study, there was no significant difference in the acne score between the groups. The kappa of agreement over time for Experimental group I showed that the per cent of women who have remained with high Waist Hip Ratio after the intervention was mild. The change over time was high for Experimental group I as can be seen by slight agreement Kappa of 0.2 (0.05-0.5), Similarly in the control group the change over time was shown as slight agreement, Kappa: 0.2(0.2-0.5) .The change seen over time for the two groups were also not markedly different. (p=0.80).

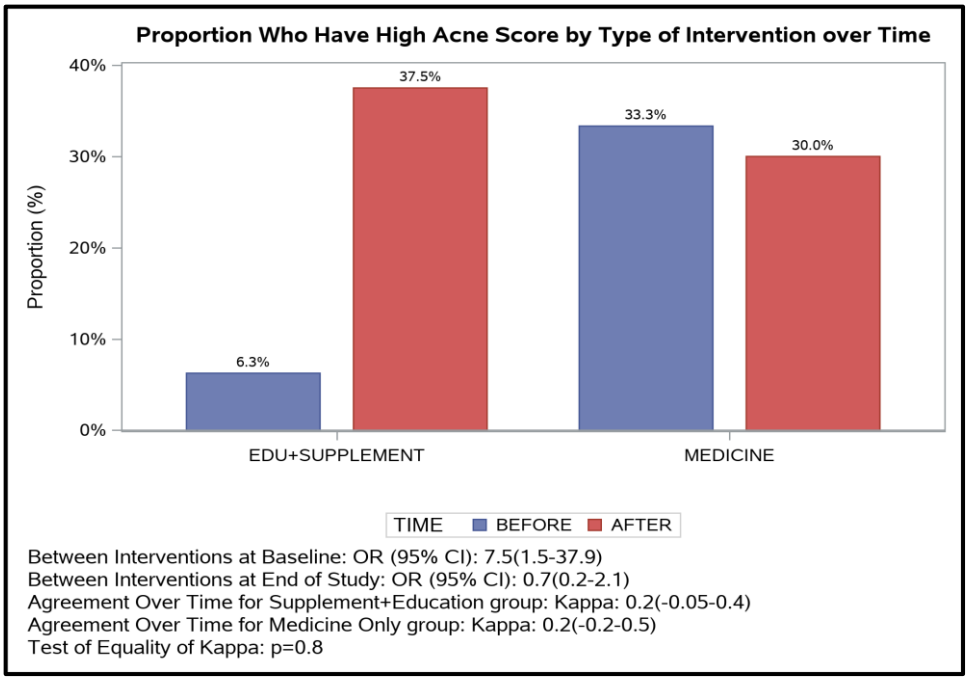

Figure 46 Proportion with High acne score by type of Intervention over time

xi) Proportion with high BMI by type of intervention over time for Experimental group I and Experimental group II

Figure 47 indicated that there was no significant difference in the proportion of high BMI between the group I (Education+ supplement) and Experimental group II (Education alone) before the intervention OR (95per cent CI): 0.96(0.2-5.2). Between the interventions at the end of the study, there was no significant decrease of waist hip ratio between the groups. The kappa of agreement over time for Experimental group I showed that the per centage of women who have remained with high BMI after the intervention was moderate. The change over time was high for Experimental group I as can be seen by moderate agreement Kappa of 0.5 (0.10-0.80), similarly in the control group the change over time was shown as moderate agreement, Kappa: 0.5(0.10-0.80) .The change seen over time for the two groups were also not significantly different. (p=0.99).

xii) Proportion with high BMI by type of intervention over time for Experimental group I and Control group

Figure 47 indicated that there was no significant difference in the proportion of high BMI between the group I (Education+ supplement) and control group (Medication alone) before the intervention OR (95per cent CI): 0.9(0.2-5.2). Between the interventions at the end of the study, there was no significant decrease of waist hip ratio between the groups. The kappa of agreement over time for Experimental group I showed that the per centage of women who have remained with high BMI after the intervention was moderate. The change

over time was high for Experimental group I as can be seen by moderate agreement Kappa of 0.5 (0.1-0.8), similarly in the control group the change over time was shown as moderate agreement, Kappa: 0.8(0.5-1.0) .The change seen over time for the two groups were also not significantly different. (p=0.10).

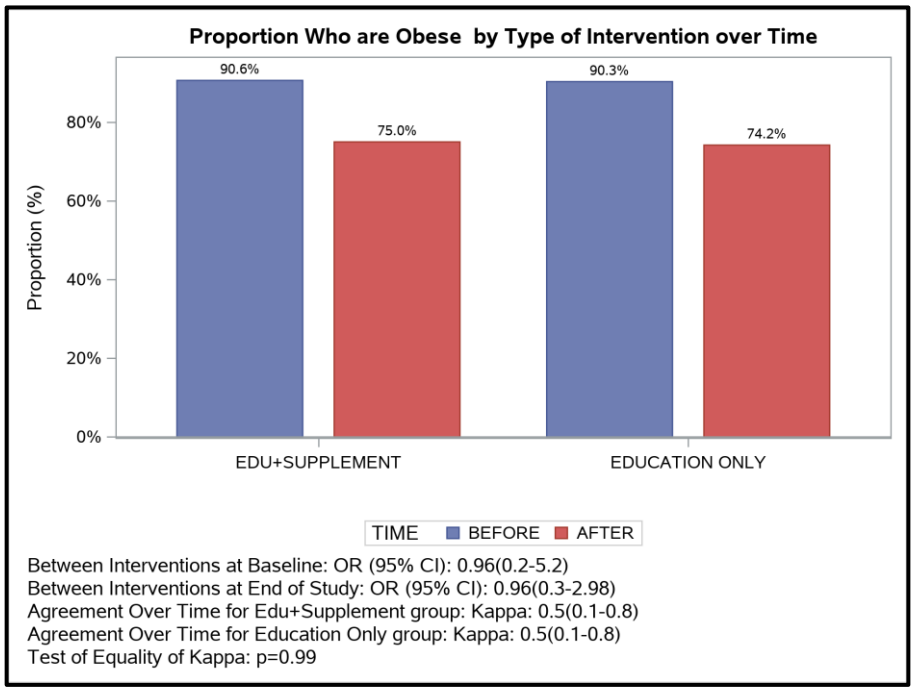

Figure 47 Proportion with High BMI by type of Intervention over study time

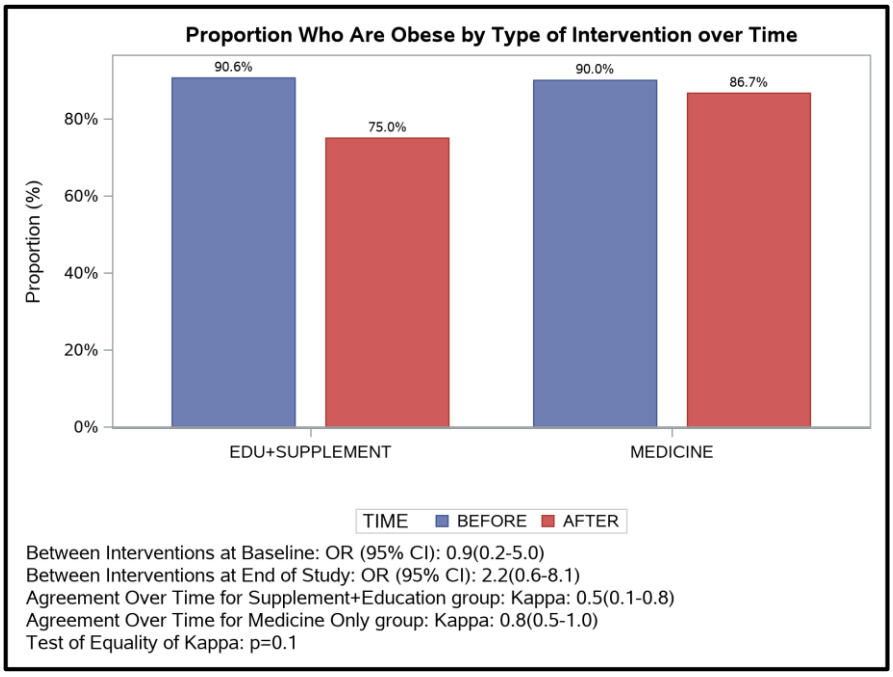

Figure 47 Proportion with High BMI by type of Intervention over study time

B) Correlation between Symptoms of PCOS and Socio economic status

The correlation between different anthropometric, clinical and biochemical symptoms of PCOS and socio economic status is represented in table LII

Table LII Correlation between Symptoms of PCOS and Socio economic status (N=93)

Correlations												
	SES	Weight	BMI	WC	HC	BF	Cholesterol	LDL	Testosterone	Hirsutism	Acne	PSS
Socio Economic Scale	1											
WEIGHT	.08	1										
BMI	.02	.91**	1									
Waist Circumference	-.14	.79**	.76**	1								
Hip Circumference	.000	.84**	.81**	.83**	1							
Body Fat	-.04	.61**	.69**	.61**	.66**	1						
Cholesterol	.06	.19	.23*	.267*	.25*	.17	1					
LDL	0.03	.28**	.33**	.29**	.29**	.25*	.92**	1				
Testosterone	.12	.05	.03	.02	-.06	-.05	.17	.02	1			
Hirsutism	.141	-.049	-.067	-.021	-.04	-.04	-.16	-.09	-.08	1		
ACNE	-.16	.14	.05	.11	.1	.12	-.10	-.09	.07	-.01	1	
PSS	.04	-.07	-.07	.10	-.07	.04	-.11	-.09	.11	.00	-.16	1
**. Correlation is significant at the 0.01 level (2-tailed).												
*. Correlation is significant at the 0.05 level (2-tailed).												

From table LII it is clear that there was a very high positive significant correlation between weight and BMI ,weight and Hip circumference and BMI and hip circumference. A Moderate significant positive correlation existed between body fat and weight , BMI ,WC, HC and Mild positive correlation was observed between LDL cholesterol and body weight , BMI , WC , HC and body fat ($p<0.05$) .No correlation existed between Socio Economic status and any of the POCS symptoms like obesity, Dysllipidaemia , hyper androgenism ,

Hirsutism and acne .correlation was insignificant for socio economic status and for PCOS symptoms

C) Association between demographic variables and symptoms of PCOS

The association among demographic variables and PCOS variables were interpreted using chi-square test and was found that, no association existed between the demographic and PCOS variables. Table LIII indicated the association of type of PCOS and socio economic status.

Table LIII Association between type of PCOS and Socio economic status (N=93)

Criteria	Socio Economic Status				Chi square	P value
	Upper lower	Lower middle	Upper middle	Upper class		
Hyper androgenism with Polycystic ovaries	11	34	31	4	1.58	0.663
Irregular periods with Polycystic ovaries	9	21	19	3	0.621	0.89
Irregular periods with Hyperandrogenism	13	30	23	3	3.84	0.278
Clinical /biochemical Hyper androgenism	12	35	28	5	1.26	0.737

Table LIII Compared the association of socio economic status with types of PCOS.There was no significant association between socio economic status and types of PCOS ($p>0.05$)

C) Association between demographic variables and symptoms of PCOS

Table LIV Association between demographic variables and symptoms of PCOS

Clinical symptoms of PCOS		Religion			Chi-square	P value
		Hindu	Christian	Muslim		
Acanthosis	Yes	26	26	5	3.22	0.200
	No	10	23	3		
Hirsutism	Yes	24	34	4	1.16	0.56
	No	12	15	4		
Acne	Yes	16	29	3	2.50	0.29
	No	20	20	5		
Depression	Yes	30	29	1	15.6	0.00
	No	6	20	5		
Mood swings	Yes	32	34	4	7.24	0.027

Clinical symptoms of PCOS		Religion			Chi-square	P value
		Hindu	Christian	Muslim		
	No	4	15	4		
Menstrual cycle	Yes	9	8	0	3.00	0.22
	No	27	41	8		
		Marital status				
		Married	**Unmarried**	**Separated**		
Acanthosis	Yes	31	26	1	1.67	0.44
	No	20	15	0		
Hirsutism	Yes	31	30	1	2.07	0.35
	No	20	11	0		
Acne	Yes	30	18	0	3.104	0.212
	No	21	23	1		
Depression	Yes	29	30	1	3.19	0.20
	No	22	11	0		
Alopecia	Yes	36	32	1	1.01	0.603
	No	15	9	0		
Menstrual cycle	Regular	6	10	1	6.95	0.03
	Irregular	45	31	0		
		Area of residence				
		Rural	Semi urban	Urban		
Acanthosis	Yes	5	40	11	1.67	0.44
	No	4	25	7		
Hirsutism	Yes	7	42	12	1.12	0.77
	No	2	23	6		
Depression	Yes	7	46	6	9.9	0.02
	No	2	19	12		
Menstrual cycle	Regular	3	11	3	1.70	0.64
	Irregular	6	54	15		
		Occupation				
		Govt	Pvt	Student	Unemployed	
Acne	Yes	2	12	19	14	9.98	0.04
	No	0	23	9	13		

Table LIV indicated that there is a significant association between Religion and depression (p=0.00). The participants in the Hindu community had more number of subjects (83 per cent) showing depression when compared to other religions Christians (59per cent) and muslims (16 per cent).Similarly moods swings were also higher in the Hindu community (88per cent) followed by Christians (69 per cent), Muslims (50 per cent) and the association between religion and mood swings was significantly higher (p=0.027)

.There was a significant association between menstrual cycle and marital status. Majority of women had irregular menstrual cycle both in married (92per cent)and unmarried groups(76per cent).Participants showing depressive symptoms had a significant association with the area where they reside (p=0.02) .Acne had shown significant association with the occupation (0.04).Acne was present in 68 per cent of students and 52 per cent in unemployed women.

D) Correlation between biochemical and clinical profile of the participants in the three study groups

a) Correlation between biochemical and clinical profile of the participants in the Experimental group I

Table LVI depicted the correlation between different clinical and biochemical profile

TABLE LV Correlation between biochemical and clinical profile of the participants in the Nutrition intervention group I

Correlations[a]							
Biochemical profile		CHOLAF*	TGAF*	LDLAF*	HIRAF*	PSSAF*	TESTAF*
Cholesterol	Pearson Correlation	1	.267	.844**	-.049	.208	.075
	Sig. (2-tailed)		.140	.000	.789	.253	.682
	N	32	32	32	32	32	32
TG	Pearson Correlation	.267	1	.350*	.028	.228	.244
	Sig. (2-tailed)	.140		.050	.878	.209	.178
	N	32	32	32	32	32	32
LDL	Pearson Correlation	.844**	.350*	1	.097	.226	-.091
	Sig. (2-tailed)	.000	.050		.596	.214	.620
	N	32	32	32	32	32	32
Hirsutism	Pearson Correlation	-.049	.028	.097	1	-.008	-.016
	Sig. (2-tailed)	.789	.878	.596		.965	.931
	N	32	32	32	32	32	32
Stress level	Pearson Correlation	.208	.228	.226	-.008	1	.245
	Sig. (2-tailed)	.253	.209	.214	.965		.177
	N	32	32	32	32	32	32
Testosterone	Pearson Correlation	.075	.244	-.091	-.016	.245	1
	Sig. (2-tailed)	.682	.178	.620	.931	.177	
	N	32	32	32	32	32	32
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

CHOLAF*-Cholesterol after TGAF*: Triglyceride after HIRAF*: Hirsutism after

PSSAF*-Perceived stress score after TESTAF*: Testosterone after

There was a high significant correlation between Total cholesterol and LDL levels (p=0.000), and mild positive correlation between Total cholesterol and Triglycerides

(p=0.05) and also with Total cholesterol and Stress levels but the relationship was not significant.

TABLE LVI Correlation between biochemical and clinical profile of the participants in the Experimental II group

Correlations[a]							
Biochemical profile		CHOLAF*	TGAF*	LDLAF*	HIRAF*	PSSAF*	TESTAF*
Cholesterol	Pearson Correlation	1	.717**	.896**	.065	.123	.316
	Sig. (2-tailed)		.000	.000	.728	.511	.083
	N	31	31	31	31	31	31
TG	Pearson Correlation	.717**	1	.706**	.099	-.031	.467**
	Sig. (2-tailed)	.000		.000	.595	.867	.008
	N	31	31	31	31	31	31
LDL	Pearson Correlation	.896**	.706**	1	.032	.175	.337
	Sig. (2-tailed)	.000	.000		.866	.345	.064
	N	31	31	31	31	31	31
Hirsutism	Pearson Correlation	.065	.099	.032	1	.092	.172
	Sig. (2-tailed)	.728	.595	.866		.622	.356
	N	31	31	31	31	31	31
Stress level	Pearson Correlation	.123	-.031	.175	.092	1	.210
	Sig. (2-tailed)	.511	.867	.345	.622		.257
	N	31	31	31	31	31	31
Testosterone	Pearson Correlation	.316	.467**	.337	.172	.210	1
	Sig. (2-tailed)	.083	.008	.064	.356	.257	
	N	31	31	31	31	31	31
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

CHOLAF*-Cholesterol after TGAF*: Triglyceride after HIRAF*: Hirsutism after

PSSAF*-Perceived stress score after TESTAF*: Testosterone after

. Table LVI demonstrated the correlation between different clinical and biochemical parameters. There was a high significant correlation between Total cholesterol and LDL levels(p=0.000), , and moderate positive correlation between Total cholesterol and

Triglycerides (p=0.000) , LDL cholesterol and Triglyceride levels (p=<001) and also with Triglycerides and Testosterone levels (p=0.008)

c) Correlation between biochemical and clinical profile of participants in the Medication (Control) group

TABLE LVII Correlation between biochemical and clinical profile of participants in the Medication (Control) group

Correlations[a]							
Biochemical profile		CHOLAF*	TGAF*	LDLAF*	HIRAF*	PSSAF*	TESTAF*
Cholesterol	Pearson Correlation	1	.619**	.901**	.170	-.393*	.309
	Sig. (2-tailed)		.000	.000	.368	.032	.097
	N	30	30	30	30	30	30
TG	Pearson Correlation	.619**	1	.580**	-.029	-.393*	.098
	Sig. (2-tailed)	.000		.001	.881	.032	.608
	N	30	30	30	30	30	30
LDL	Pearson Correlation	.901**	.580**	1	.148	-.229	.332
	Sig. (2-tailed)	.000	.001		.435	.225	.073
	N	30	30	30	30	30	30
Hirsutism	Pearson Correlation	.170	-.029	.148	1	-.258	-.044
	Sig. (2-tailed)	.368	.881	.435		.168	.818
	N	30	30	30	30	30	30
Stress level	Pearson Correlation	-.393*	-.393*	-.229	-.258	1	.021
	Sig. (2-tailed)	.032	.032	.225	.168		.913
	N	30	30	30	30	30	30
Testosterone	Pearson Correlation	.309	.098	.332	-.044	.021	1
	Sig. (2-tailed)	.097	.608	.073	.818	.913	
	N	30	30	30	30	30	30
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

CHOLAF*-Cholesterol after TGAF*: Triglyceride after HIRAF*: Hirsutism after

PSSAF*-Perceived stress score after TESTAF*: Testosterone after

Table LVII demonstrated the correlation between different clinical and biochemical profile of the participants in the control group .There was a very high significant correlation between Total cholesterol and LDL levels(p=0.000), , and moderate positive correlation

between Total cholesterol and Triglycerides (p=0.000) , LDL cholesterol and Triglyceride levels (p=001) and a mild negative correlation between total cholesterol and stress levels, Triglycerides and stress levels

To conclude **,**the correlation was insignificant for socio economic status and PCOS symptoms No correlation existed between Socio Economic status and any of the POCS symptoms like obesity, Dyslipidaemia, hyper androgenism , Hirsutism and acne .A Mild negative significant correlation between total cholesterol and stress levels , Triglycerides and stress levels was observed in the control group .A moderate positive correlation existed between Triglycerides and Testosterone levels (p=0.008) in the Experimental II group . There was a significant association between menstrual cycle and marital status. Participants showing depressive symptoms had a significant association with the area of area of residence. There was no significant association between types of PCOS and any of the demographic variables