Chapter IV

Results and Discussion

The results of the present investigation titled "“**Development and Evaluation of Nutraceutical Energy Rich Nutribar on the Sprint Performance of Women Athletes During Covid- 19 Pandemic**” are represented and shown under the following headings:

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Phase I

4.1 Acceptability of the Nutraceutical Energy Rich Nutribar for Sprinters

4.1.1 Sensory scores of the developed food product

Sensory evaluation was performed to find out the acceptability level of the product among the consumers. It is used as an instrument to evaluate, determine or enhance the quality of products. The sensory quality is a combination of different perceptions that come into play in choosing and eating food. The sensory characteristics of food are appearance, colour, texture, taste, flavor, and overall acceptability.

The developed food product's organoleptic assessment scores, as measured by a 9-point rating system, are shown below.

Mean scores found for the Nutribar in sensory evaluation are given in Table V

Table V The mean scores obtained for the Nutribar prepared with varying proportions in sensory evaluation

Variations	Colour	Texture	Appearance	Taste	Flavor	Overall Acceptability
Standard	7.48±1.12	7.28±1.1	7.32±1.37	7.51±1.7	6.84±1.1	6.36±1.25
V1	7.88±0.72	7.72±0.93	7.76±1.09	7.64±0.98	7.48±1.0	7.44±1.04
V2	8.08±0.81	8.16±0.89	7.96±1.13	8.26±0.93	7.36±1.8	7.68±1.55
V3	7.04±1.05	6.84±1.14	6.88±1.48	7.44±1.28	6.4±1.61	6.48±1.47

From the above data, the sensory assessment of the developed product revealed that variant 2 of the formulated product scored the highest of the three formulations. The mean score found for colour of Variant V2 were maximum (8.08±0.81) followed by V1 (7.88±0.72), standard (7.48±1.12), and V3 (7.04±1.05). The higher the *U.fasciata*, the darker the formulations. The mean scores observed for appearance of variant V2 were maximum (7.96±1.13) followed by V1 (7.76±1.09), Standard (7.32±1.37), and V3 (6.88±1.480). Texture, flavour, and taste all followed a similar pattern. It is found that mean overall acceptability of Variant V2 was 7.68±1.55 Variant V1 was 7.44±1.04, Variant V3 was 6.48±1.47 and the standard was 6.36±1.25. Variant V2 highest mean overall acceptability score than V1, V3, and standard.

The results of ANOVA comparing the sensory scores of Nutribar prepared with varying proportions are given in Table VI.

Table VI ANOVA comparing the Mean sensory Scores Obtained for Nutribar prepared with varying proportions

Criteria	Sources of Variation	Sum of Squares	Df	Mean Square	F	Sig.
Colour	Between Groups	31.760	3	10.587	12.109	.000*
	Within Groups	171.360	196	0.874		
	Total	203.120	199			
Texture	Between Groups	48.400	3	16.133	15.685	.000*
	Within Groups	201.600	196	1.029		
	Total	250.000	199			
Appearance	Between Groups	34.720	3	11.573	7.197	.000*
	Within Groups	315.200	196	1.608		
	Total	349.920	199			
Flavour	Between Groups	37.200	3	12.400	6.096	.001*
	Within Groups	398.720	196	2.034		
	Total	435.920	199			
Taste	Between Groups	147.095	3	49.032	23.808	0.001*
	Within Groups	403.660	196	2.059		
	Total	550.755	199			
Overall acceptability	Between Groups	74.880	3	24.960	12.583	0.000*
	Within Groups	388.800	196	1.984		
	Total	463.680	199			

** Significant at 1% (p<0.001)

Statistical analysis on ANOVA comparing the Mean sensory scores obtained for Nutribar prepared with varying percentage proportions revealed that there was a significant (p<0.001) difference between all the three variations and standard for sensory characters such as color, texture, taste, appearance, flavour, and overall acceptability.

Table VII presents data on the Post – Hoc Duncan's test for analysing multiple comparisons between varying proportions of functional foods incorporated in Nutribar.

Table VII Duncan's test for multiple comparisons of mean sensory score obtained by Nutribar with Different Levels

Duncan[a,b]	Variant	N	Subset for alpha = 0.05			
			1	2	3	4
Colour	S	52		7.4800		
	V_3	52	7.0408			
	V_2	52			8.0800	
	V_1	52		7.4800		
Texture	S	52		7.2800		
	V_3	52	6.8367			
	V_2	52				8.1600
	V_1	52			7.7200	
Appearance	S	52	6.8400			
	V_3	52	6.8776			
	V_2	52		7.9600		
	V_1	52		7.7600		
Flavor	S	52		6.8400	6.8400	
	V_3	52		6.3878		
	V_2	52			7.3600	
	V_1	52			7.4800	
Taste	S	52		6.3800		
	V_3	52	5.5200			
	V_2	52				7.8200
	V_1	52			7.1400	
Overall acceptability	S	52	6.1600			
	V_3	52	6.4694			
	V_2	52		7.6800		
	V_1	52		7.4400		

From the above table, It was evident that the mean score pertaining to the overall acceptability of the 2nd variation Nutribar differed significantly from the standard developed product. Among the Standard and three variations, it was observed that the Nutribar with the second variation was popularly preferred and gained a significantly high score ($p< 0.001$) than the variation I and III and was considered the best among all the variations with the highest mean of 7.68 of overall acceptability followed by the first variation with a mean of 7.4.

The significant difference between control sample and the variation was due to the incorporation of raw ingredients namely sweet potato flour, seaweed (Ulva fasciata) and basil seeds in the variation which was not included in the control sample. The supporting evidence for the difference in sensory evaluation are mentioned below: Salam et al., in 2022 developed high energy protein bars as a nutritional supplement for sports athletes and found out that although all samples had a high acceptance, the sample containing sweet potato was the most preferred by the panelist in terms of taste, odour and texture according to 9-point Hedonic scale rating. In the present study as well, sweet potato flour was included to enhance the taste of the developed nutribar.

Brownlee et al., 2012 reported that seaweed as a foodstuff has been historically consumed around the globe but is only consumed in appreciable amounts in certain areas of the world today. Seaweed polysaccharides were used within the food industry in a wide number of important food products particularly aiming at improving the sensory properties and shelf-life of food products. Due to the benefits mentioned above, seaweed was included in the nutribar in the form of dried powder. Figure 7 represents the mean organoleptic scores between standard and Variation 2 Nutribar

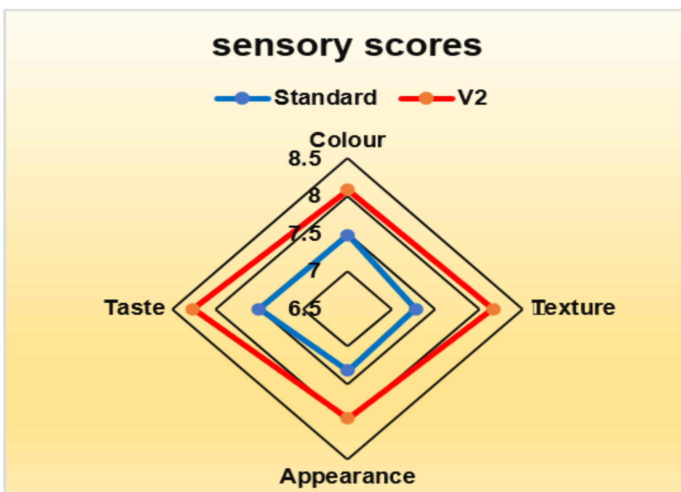


Figure 7
Mean organoleptic scores between standard and Variation 2 Nutribar

From the above Figure, it was evident that Variation 2 has a higher score than the standard product. Depending upon the results of sensory analysis, the mean score of the second variation is higher than the mean score of other developed product variations. Hence, 2^{nd} variation Nutribar was chosen for the nutrient analysis with the standard.

4.1.2 Cost of the Nutribar

The cost of the Nutribar (per 100g) was calculated by totaling the cost of the ingredients. The cost of preparation of 100 g Nutribar was Rs.30/- in Indian Rupees. Each Nutribar weighed 50g. Hence the cost of each Nutribar was Rs.15/-. The cost of Nutribar when compared with other commercial products reveals that the cost is minimal and affordable.

Thus, the result of this phase proves that, with a selection of nutrient dense foods, suitable processing methods adopted for convenience foods can be developed.

Phase II

4.2 Nutrient and Nutraceutical Potentials and Shelf-Life Studies of developed product

4.2.1 Macronutrient and Micronutrient content of the developed product

The nutrient analysis of a given sample, according to Singh *et al* (2005), should provide information regarding the sample's nutrient composition. Moisture, ash, energy, protein, fat, carbohydrate, fiber, calcium, iron, potassium, zinc, and beta carotene were all measured for both developed Nutribar and standard. The Nutritive Value of the Nutribar and standard product for 100 g are presented in Table VIII

Table VIII: Nutritive value of Developed Nutri-bar (100g)

Parameters	Standard	Variation-2
Energy (kcal)	400.7	441
Protein (g/100g)	10.2	11
Fat (g/100g)	9.5	15.5
Carbohydrate (g/100g)	52.64	48.5
Dietary Fibre (g/100g)	11.8	12.4
Crude Fibre (g/100g)	4.2	3.5
Zinc (mg/100g)	0.73	1.20
Iron (mg/100g)	2.6	5.8
Magnesium (mg/100g)	22.0	35.6
Calcium (mg/100g)	80.1	89.5
Beta carotene(mcg/100g)	5.8	30
Moisture (%)	10.5	7.3
Total Ash (%)	1.2	1.8

The energy content of the Standard Nutribar was found to be 441 Kcal. While its protein content was found to be 11.0g and fat content was found to be 15.5g. whereas the standard product contained 400.7 Kcal of energy; 10.2g of protein and 9.5 g of fat. The developed nutribar contained 12.4 g of dietary fiber and 3.5 g of crude fiber whereas the standard product contained 11.8 g of dietary fiber and 4.2g of crude fiber. The total carbohydrate contents of the standard product are higher than that of Nutribar due to the difference in the level of protein, fat, ash and moisture content.

The zinc and iron content of the developed Nutibar was 1.20 and 5.8mg/100g. whereas, the standard product consisted of 0.73 and 2.6mg/100g respectively. The greater percentage of vitamins and minerals in the Nutribar can be attributed to the presence of sweet potato, *ulva lactuca* and basil seeds.

The results on the analysis of the nutrient composition of Nutribar and standard product revealed that the developed Nutribar contains greater amount of nutrients than the standard product. The developed Nutribar was rich in nutrients due to the addition of sweet potato, Basil seeds and seaweed during the preparation. The decreased content of nutrients in the standard product may be due to the presence of corn flour, since cornstarch is abundant in calories and carbohydrates but poor in protein, fibre, minerals and vitamins.

Sneha *et al* (2012) developed biscuit incorporating sweet potato powder which resulted in increased carbohydrate, dietary fiber and other nutrient contents of the biscuits. Similar findings was reported by Singh *et al* (2009) stating that usage of such value added foods might aid in improving the population's nutritional state, particularly the most vulnerable.

Figure 8 depicts the comparison of the Macronutrient content of standard and Nutribar.

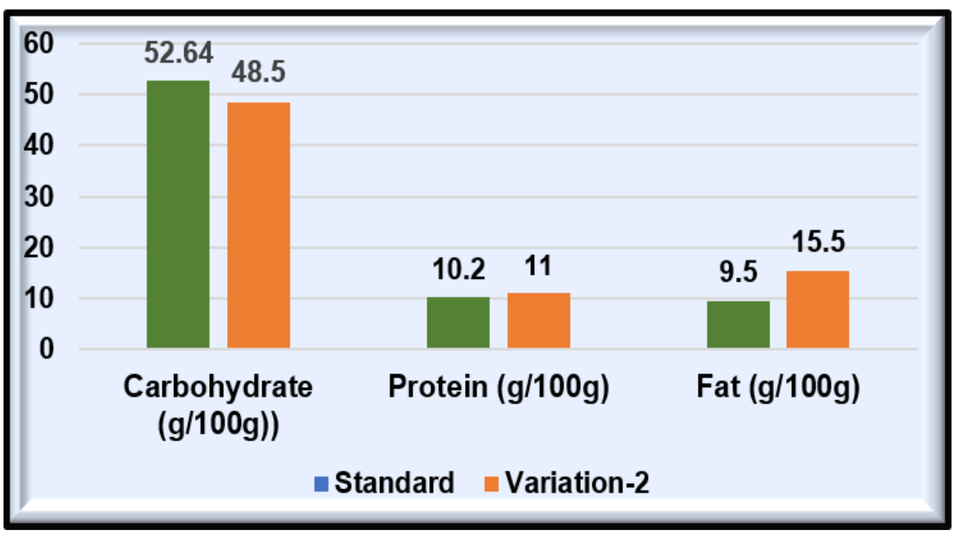


Figure 8

Macronutrient content of standard and Nutribar (g/100g)

4.2.2 Nutraceutical Potentials of the developed Nutribar

The phytochemical screening of the selected nutria bar and standard by qualitative analysis and quantitative analysis for substances like flavonoid, alkaloid, terpenoids, glycosides, tannins, phenolic acid, and saponin was conducted and the results are given in Table IX and Figure 9.

Table IX: Nutraceutical Potentials of Nutribar (100g)
(Qualitative and Quantitative)

Description	**Standard**	**Variation**	***Standard***	***Variation***
Flavonoids (Quercetin/g)	+	+	1.2	3.2
Alkaloids (Atropine/g)	+	+	0.6	1.8
Terpenoids (Linalool/g)	+	+	0.3	0.7
Glycosides (Securidaside/g)	-	+	Nil	0.2
Tannin (Tannic acid/g)	+	+	0.1	0.6
Phenol (Gallic acid/g)	+	+	1.3	2.1
Saponin (Diosegenin /g)	+	+	0.08	0.5

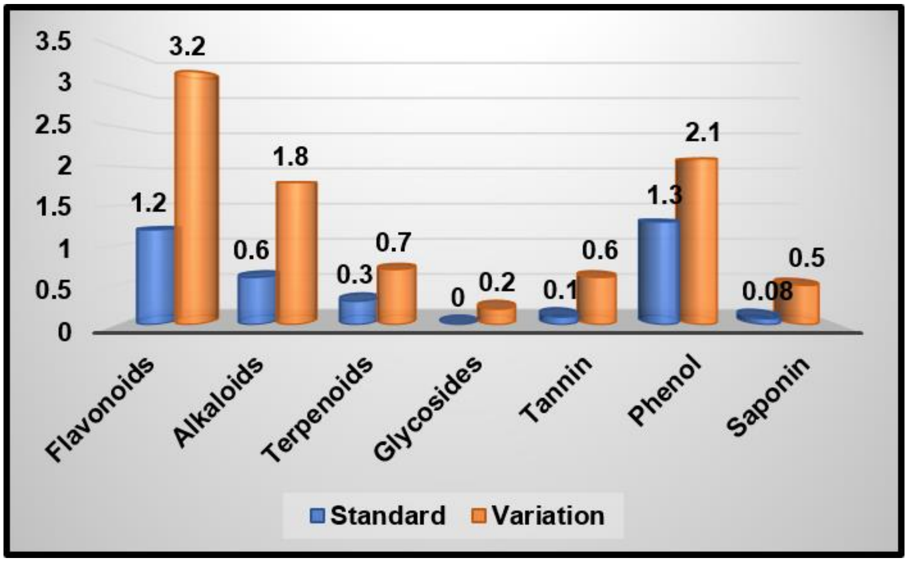


Figure 9

Phytochemical content of standard and Nutribar

From Figure 9 it is observed that the standard Nutribar had 3.2mg quercetin equivalent of flavonoids; 1.8 mg atropine equivalent of alkaloids; 0.7 mg linalool equivalent of terpenoids; 0.2 mg securidaside equivalent of glycosides; 0.6 mg tannic acid equivalent of tannin and 2.1 mg gallic acid equivalent of phenolic acid, which was found to be in high concentration in the Nutribar when compared to the standard.

From the above data it was observed that phytochemical screening exhibited secondary metabolites namely alkaloids, tannin and phenolic compounds, flavonoids, alkaloids, terpenoids, saponin, and glycosides in the developed food product whereas glycosides were absent in the standard product.

From the above results, it is evident that the developed Nutribar was richer in phytochemicals than the standard product which may be due to the presence of *Ulva fascita* in the Nutribar. Phytochemicals such as Polyphenols are biologically active compounds significantly found in seaweeds Chandini *et al., (*2008). Similarly, in 2012 Abirami and Kowsalya reported higher nutraceutical potentials of seaweed biomass such as *U. fasciata, U.lactuca* etc.

4.2.3 Total Antioxidant Capacity of developed Nutribar

The Total Antioxidant Capacity of the standard and developed Nutribar has been statistically studied and reported in Table X.

Table X Mean ± SD value of Total Antioxidant Capacity of Standard and Nutribar

Total Antioxidant Capacity in Vitamin C (μg/g)	Mean	Mean ±SD	Std, Error Mean
Standard	97	97±0.2	0.11547
Developed	158	158±0.1	0.05774*

*** Significant at (p<0.05)**

The outcomes on the statistical analysis of Total antioxidant capacity between standard and selected Nutribar by pair t test revealed that the Nutribar was found to be high in concentration 158 μg/ gram equivalent of ascorbic acid when compared to the standard which contained 97 μg/ gram equivalent of ascorbic acid. This might be due to the presence of basil seeds and seaweed in the developed product. Several researchers have revealed that basil seeds have a high antioxidant capacity, even higher than other seeds like sesame or red seeds and that they might be used to generate novel natural antioxidants or added to foods to avoid oxidative deterioration (Mezeyova 2020. In 2005, Athukorala *et al* had also discussed that Marine algae as a richer source of antioxidants due to their high content of polyphenol, tocopherol, beta carotene, and chlorophyll with high efficiency equivalent to that of commercial antioxidants. Hence, the use of natural antioxidants marine algae in developing food products enhances antioxidant properties.

Similarly, Corsetto *et al (2020)* investigated antioxidant potential of seaweed extracts for the enrichment of convenience foods and found out that seaweed-based components might be utilised as active ingredients in functional food products and could improve the oxidative stability of healthy food items for targeted customers.

4.2.4 Shelf-life analysis of the standard and Nutribar

Table XI and XI shows the storage stability of the developed nutribar stored from 0-7th, 14th, 21st, and 28th days for storage studies for the Standard and developed product on room temperature as well as refrigerated temperature 4^0C

Table XI: Shelf Life Study for 4 weeks at room temperature

	Total Fungal Count		Total Bacterial Count	
Days	**Standard cfu/g**	**Variation-2 cfu/g**	**Standard cfu/g**	**Variation-2 cfu/g**
0-7th	$18x10^1$	$9x10^1$	$48x10^1$	$68x10^1$
14th	$20x10^1$	$10x10^1$	$50x10^1$	$77x10^1$
21st	$22x10^1$	$18x10^1$	$54x10^1$	$80x10^1$
28th	$68x10^1$	$21x10^1$	$59x10^1$	$85x10^1$

*Below Detectable Level

The study on shelf life at room temperature revealed that on the 0-7th day, the total bacterial count and total fungal count were below the detectable level for the developed Nutribar, whereas the total bacterial counts and total fungal count of the standard product were found to be below detectable level on the 0-7th day and above detectable level on the 7th day as it is visible in the Plates 12 and 13. The shelf life of the Nutribar was found to be best within one week of preparation at room temperature. The TBC counts and TFC counts of Standard and developed Nutribar from 7th day to 30th day on room temperature was shown in the plate 12 and plate 13 respectively.

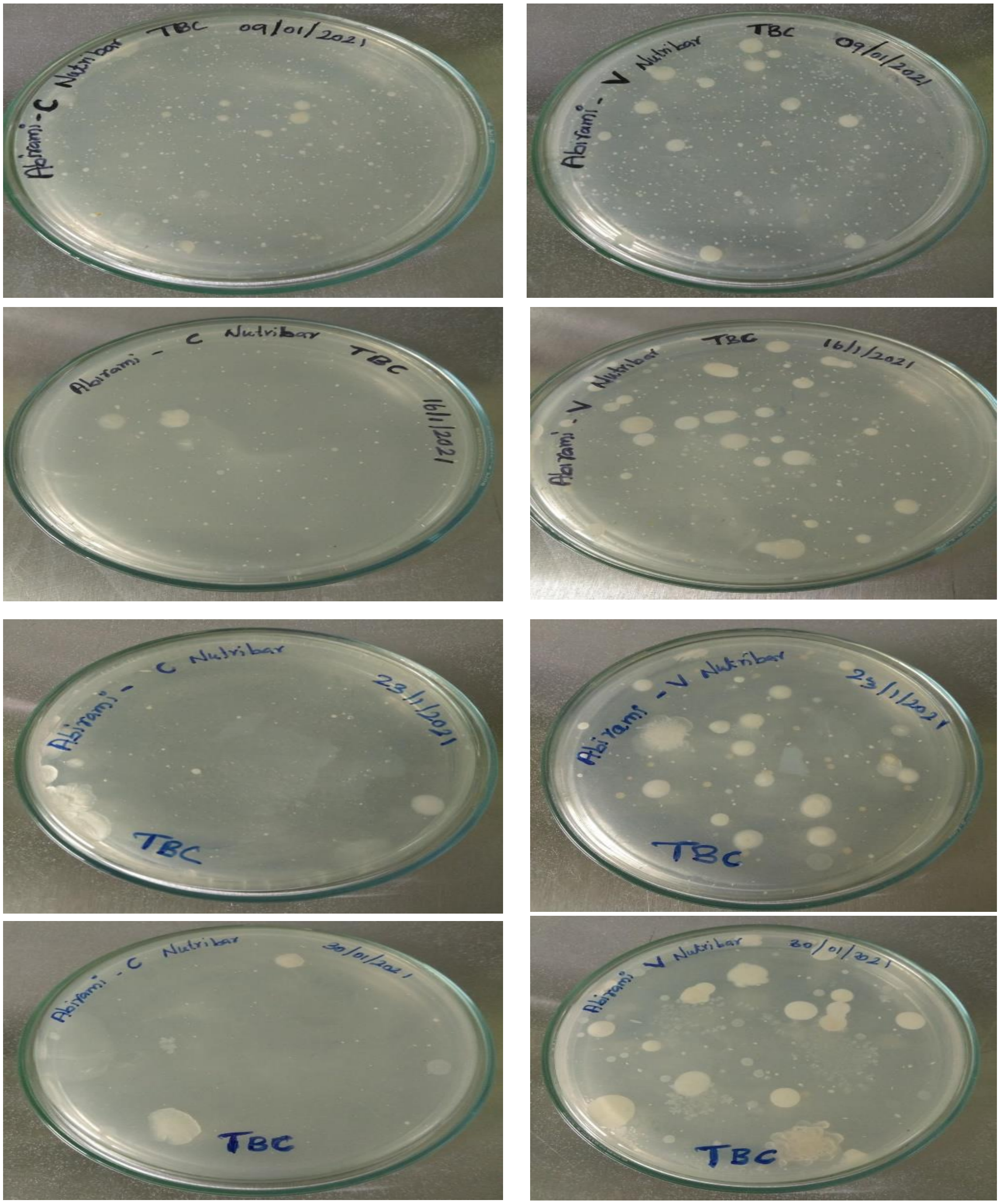


Plate 12 Total Bacterial Count of Standard and developed Nutribar from 7th day to 30th day on room temperature

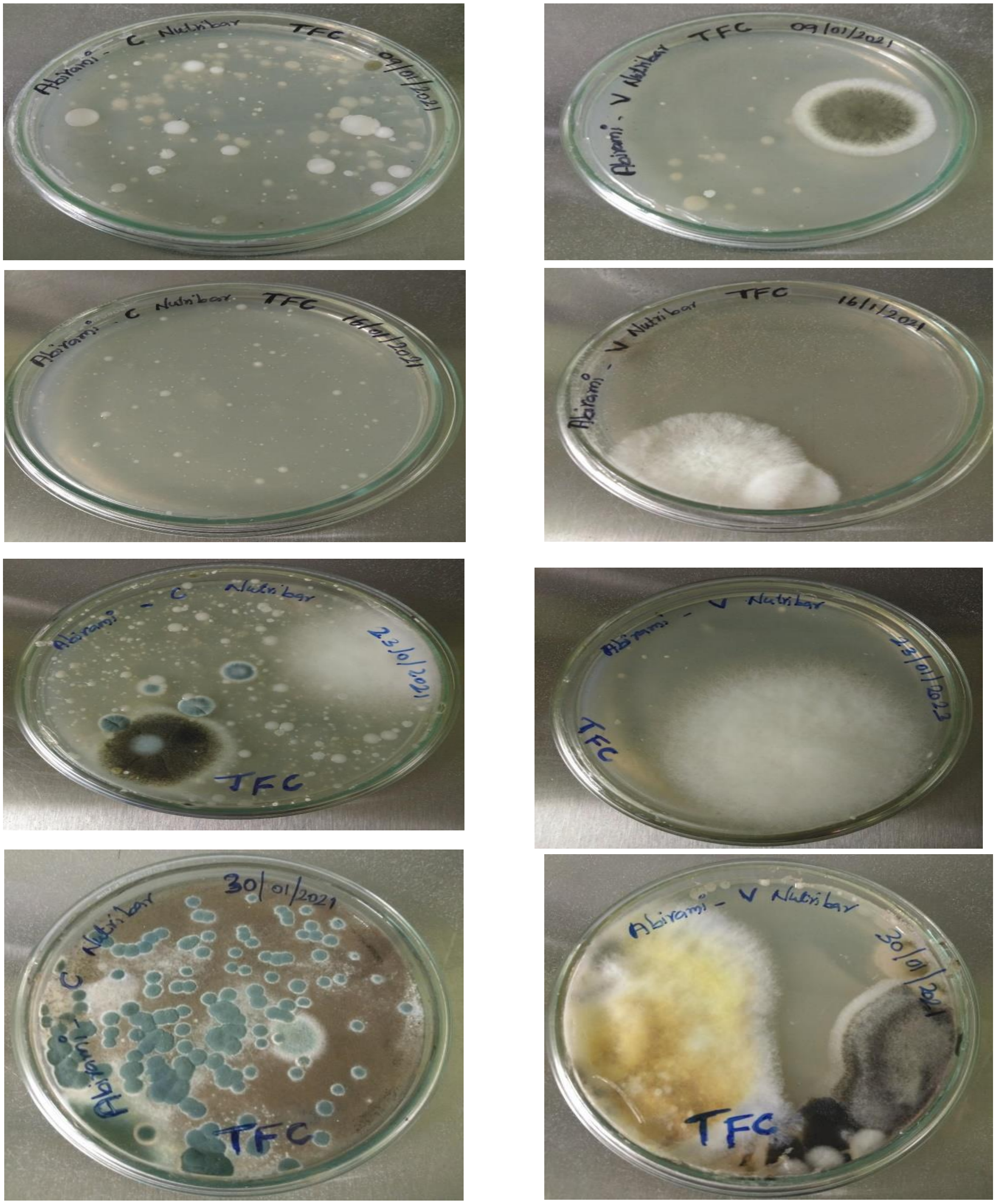


Plate 13 Total Fungal Count of Standard and developed Nutribar from 7th day to 30th day on room temperature

Table XII: Shelf Life Study for 4 weeks at 4^0C

Days	pH		Acidity %		Peroxide value milli.eq/kg		Total Bacterial Count (cfu/g)		Total fungal count (cfu/g)	
	Std	V2	Std	V2	Std	V2	Std	V2	Std	V2
0-7th	5.0	5.0	0.024	0.04	0.86	0.75	$80x10^1$	$54x10^1$	5	Absent
14th	4.9	4.8	0.043	0.070	0.92	0.80	$88x10^1$	$60x10^1$	10	5
21st	4.3	4.5	0.050	0.092	0.98	0.91	$10x10^2$	$65x10^1$	13	9
28th	4.0	4.1	0.057	0.120	1.10	0.97	$11x10^2$	$70x10^1$	20	10

The study on shelf life at refrigerator temperature of 4°C of the developed Nutribar and standard product revealed that the presence of fungus was not seen in the standard product and Nutribar from 0-7th days of storage period. On the 14th day and the 21st day, the total fungal count was found to be below the detectable level for the developed Nutribar, whereas the presence of fungus was found in the standard product. The total bacterial count for both standard product and developed product were found to be below the detectable level from 0-7th day to 28th day of storage studies. The pH of the product decreased from 5.0 to 4.0 for both standard and developed Nutribar within 28 days. the drop in pH is highly favorable for yeast and mold growth in these products since these organisms are relatively more acid-tolerant. The peroxide value and acidity increased for both standard and Nutribars within 28 days. From the above results, it was found that the shelf life of the Nutribar was found to be best within three weeks of preparation at a refrigerator temperature of 4°C. The developed Nutribar's low microbial load was attributed to minimal water activity.

According to Ibeanu *et al.,* (2015), Microbial growth in foods requires particular circumstances, including accessible water (water activity), suitable pH, nutrients and the right temperature, as well as time. These factors may be controlled to inhibit microbial development and increase the shelf life of food.

According to Prevention of food Adulteration Act (1995), the yeast and mold count that is the fungal should not be more than 10 cfu per gram for chocolate products. Hence the developed product in refrigerated temperature is safer for consumption.

Similar studies were also conducted by Gartaula and Bhattarai (2014) on the microbial quality of Bomboyson - a conventional thermally dehydrated dairy product from eastern Nepal by substituting jaggery for sugar, and found that the foods were safe for human consumption for 28 days at 5° C and 21 days at 25° C.

Oosthuizen et al. (2007) evaluated accessibility and storage stability of a dietary multi-mix prepared for South African (rural) children by incorporating biscuits made up of peanut butter, sugary and spicy muffins have reported similar findings. The overall colony forming count was well below digestible limits, and biscuit kept at 32^{O}C for seven days. On the second day, the TBC for both the sweet and savoury muffins held at room temperature grew from log 1.74/g and log 2.2/g, respectively, to more than log 6/g. In most rural towns, the sweet and savoury muffins can only be maintained suitable for human consumption at room temperature for 24 hours due of the high colony forming units per grams.

The TBC counts and TFC counts of Standard and developed Nutribar from 7th day to 30th day on 4^{0}C was shown in the plate 14 and plate 15 respectively.

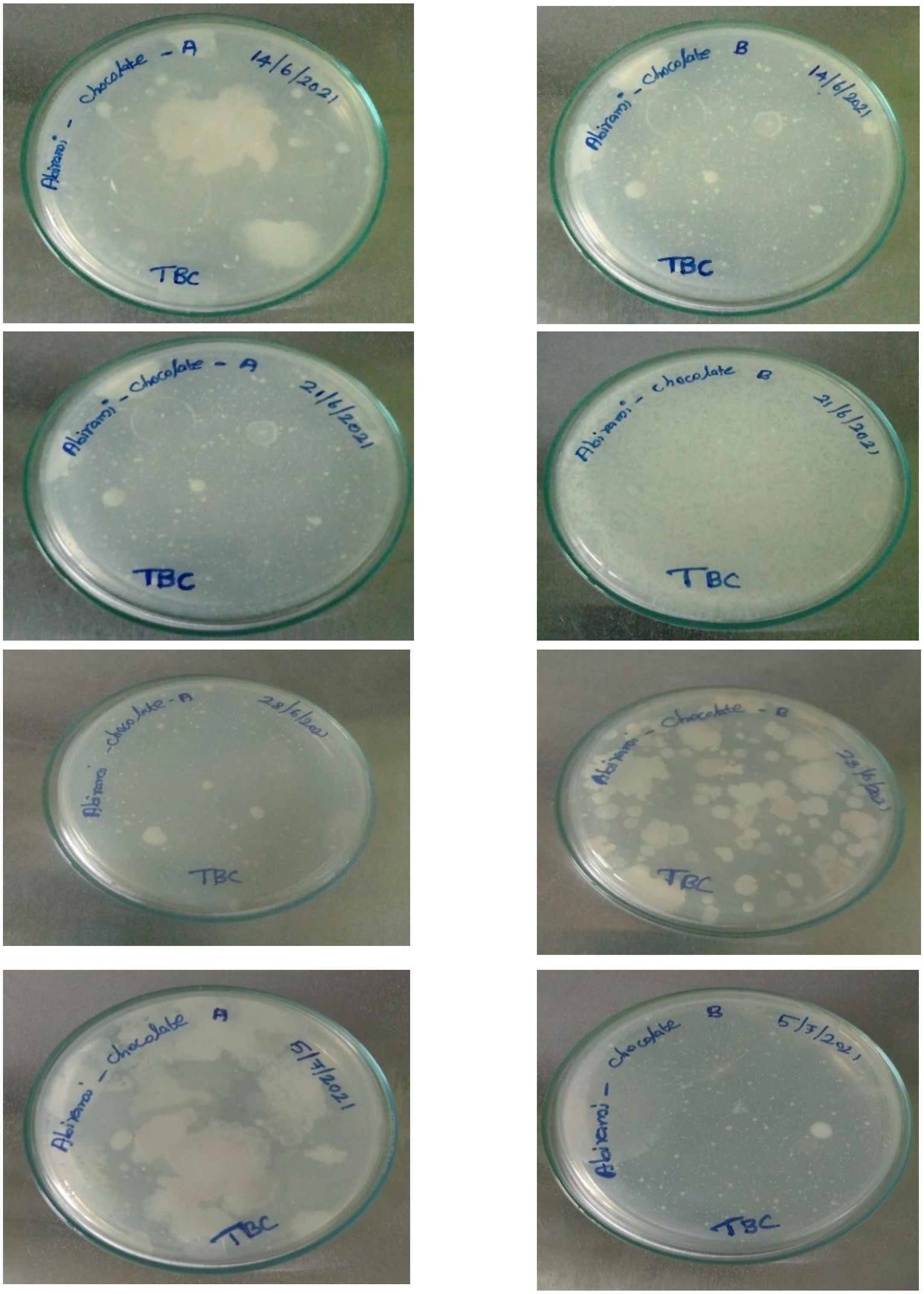


Plate 14 Total Bacterial Count of Standard and developed Nutribar from 7th day to 30th day on refrigerated temperature (4° C)

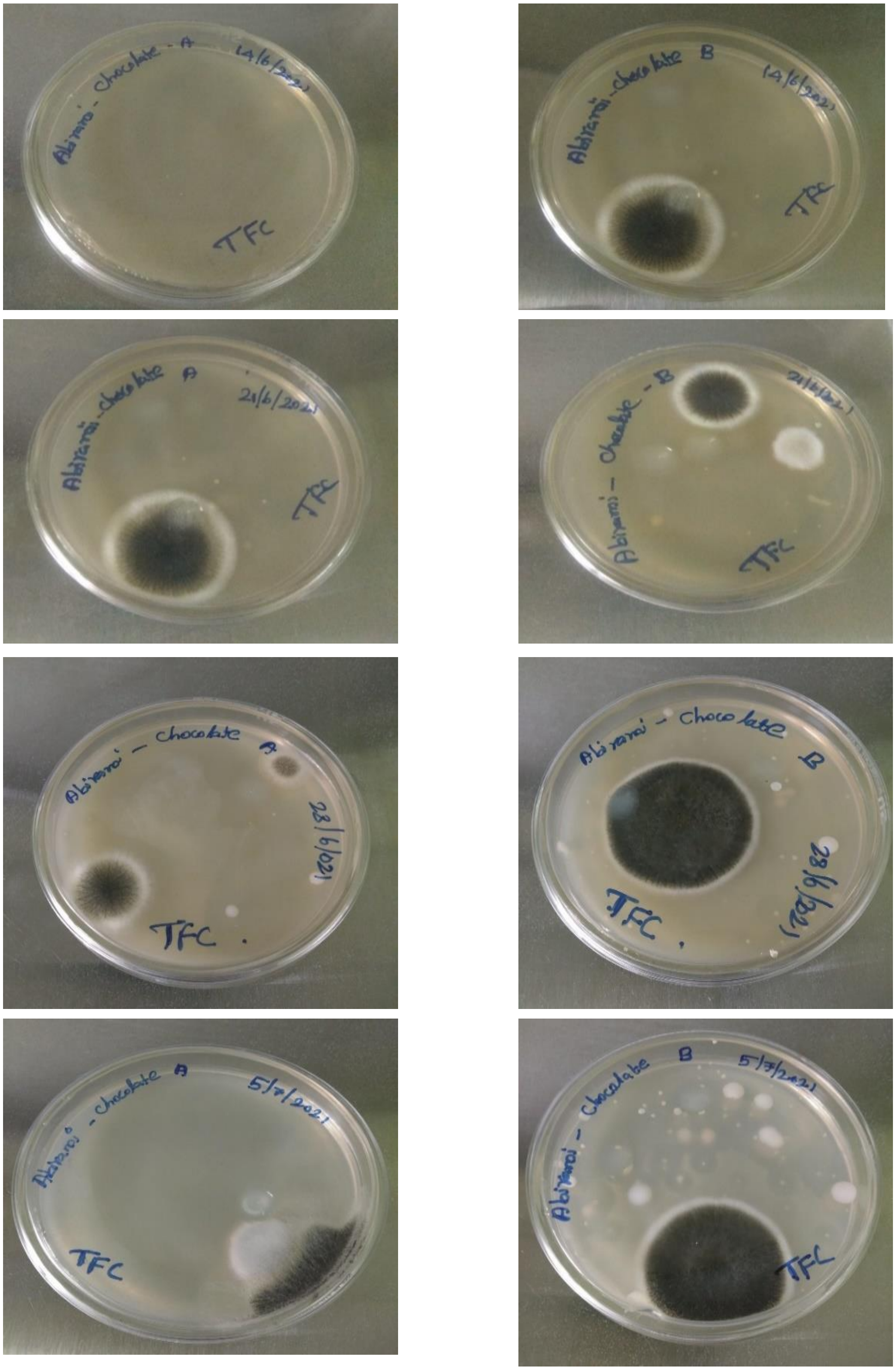


Plate 15 Total Fungal Count of Standard and developed Nutribar from 7th day to 30th day on refrigerated temperature (4° C)

Phase III

4.3 Background Information of the Sprinters

4.3.1 Socio Economic Status of the Athletes

Srilakshmi (2006) defines nutrition as the study of the social, economic, cultural, and psychological effects of food and eating. Age, gender, and lifestyle, according to Gandy *et al* (2006), influence nutritional requirements. Table XIII presents the socioeconomic background evidence of sprinters

Table XIII: Socio Demographic Background of the selected sprinters

N=140

Socio economic Factors	Categories	Number	%
Age of girls (17- 20 yrs)	17-18 yrs	44	31.4
	19- 20 yrs	96	68.6
Socio-economic factors	Categories	Women Sprinters (N= 140)	
		NO.	%
Type of family	Nuclear	97	69.3
	Joint	43	30.7
Size of the family	2-3	59	42.2
	4-5	69	49.3
	>5	12	8.6
Monthly income*	**Rs 1000-33000** Low income (Bottom most quintile)	28	20
	Rs 33001-55000 Low income	32	22.9
	Rs 55001-88800 Low middle	36	25.7

Socio economic Factors	Categories	Number		%	
	class				
	Rs 88801-150000 Upper middle class	27		19.3	
	Above 150000 High income(Top most quintile)	17		12.2	
Occupation Of the Parents		Father		Mother	
		NO.	%	NO	%
	Labourers	32	22.9	27	19.3
	Agriculture	29	20.7	30	22
	Business	21	15	10	7.2
	Government jobs	9	6.4	9	6.4
	Private sectors	25	21.8	6	4.3
	House wife	-	-	52	37.2
	Others	24	17.2	6	4.3

Among the 140 subjects, most of the selected sprinters for the preset study was 18-19 years of age (68.6%) followed by 17-18 years (31.4%). Individual nutritional status is influenced by the size and kind of household. The majority of teenage females (69.3%) lived in a nuclear family, while the remaining 30.7 percent lived in a joint household. In this study, around 49.3% of respondents stated their family consisted of four to five persons.

Figure 10 represents the age wise distribution of the sprinters

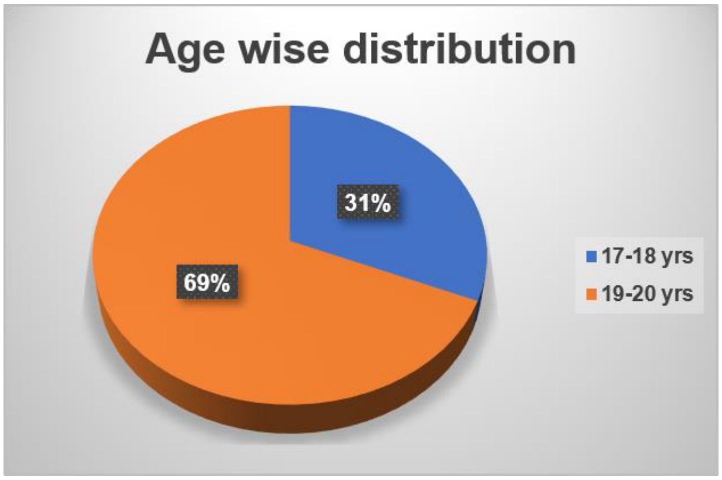


Figure 10

Age wise distribution of the sprinters

The Anthropological Survey of India's People of India Database (2010) documented 631 cultural, ecological, and economic aspects of the 4635 communities to which the whole Indian population is categorised and found a link between family size and socioeconomic status. They came to the conclusion that economic variables have a similar impact on desired family size across ethnic groups.

Among the 140 sprinters, 20 per cent of the sprinters were from a low-income household with an annual income of Rs 33001 to 55000 per annum followed by 25.7 per cent in the lower middle class with Rs 55001 to 88800 per annum according to the National Council for Applied Research (NCAER) and Planning Commission's criteria (Hindu dated 5.4.2014). Figure 11 depicts the Respondents were categorised depending on their monthly income.

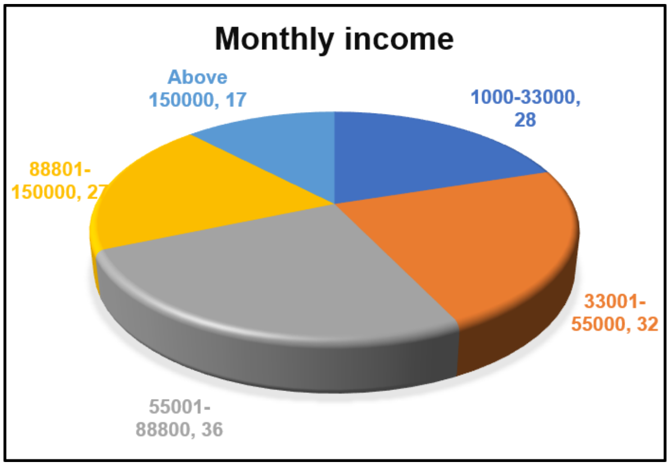


Figure 11

Classification of Respondents Based on Monthly Income

Rendering to this norm 57 per cent of the families were above poverty line. Nineteen per cent and twelve percent fell under upper middle class and high-income category respectively. Twenty per cent of the families fell under very poor income class with Rs 1000 to 33000 per annum.

Parents' occupations showed that the majority of adolescent girls' fathers (22.9%) and mothers (19.3%) were labourers. About 15% of adolescent girls' fathers worked in the business world, while 21.8 per cent worked in the private sector. Mothers had jobs that were distinct from those of fathers. About 4.3 per cent of mothers worked in the private sector, while 37.2 per cent of mothers stayed at home. Government employees composed just 6.4 per cent of mothers and 6.4 percent of fathers.

Ryagi (2011) found a significantly positive impact of socioeconomic situation on sportswomen's self-confidence and performance ambition. Their high socioeconomic status would benefit them greatly in terms of a higher standard of living, greater income, positive self-image, high dignity and social position, superior training facilities, and the accompanying strong self-confidence, which usually supports them in developing positive personality characteristics and higher accomplishment motivation.

Phase IV

4.4 Nutritional Status and Physical Performance of the Sprinters

Anthropometric measurements, biochemical status, clinical examination, and dietary habits were used to determine the nutritional health of the selected sprinters (ABCD).

4.4.1 Anthropometric parameters

4.4.1.1 Standing Height and Body Weight of selected sprinters

Anthropometric parameters play a significant effect on athletic performance. A good physique is required for quality performance in particular sports, according to several research.

Mean height, weight and BMI distribution according to height and weight of the selected sprinters are given in Table XIV.

Table XIV Mean Anthropometric Measurements of the Selected Subjects

n=60

Subjects	Age (yrs)	Height (cm)	Std values*	Weight (kg)	Std values*	BMI (kg/m^2)	Std values*
(age=17-18)	17-18	157.87±5.45	162	55.35± 11.60	55	22.12 ±4.32	21
(age= 19-20)	**19-20**	**157.39 ±5.41**		**54.99 ±11.69**		**22.11 ±4.17**	

*ICMR 2020

Baseline anthropometry data found the mean height and weight and BMI of the selected subjects of 17-18 years of age were recorded as 157.87cm, 55.35 kg and 22.12 kg/m^2 whereas the subjects of 19-20 years of age were recorded as 157.39 cm, 54.99 kg and 22.11 kg/m^2 respectively. Both sprinters in the age group 17-18 and 19-20 years were significantly shorter than their respective ICMR 2020 standard counterparts. The BMI and weight of the selected sprinters for both age groups were found to be slightly higher than the reference values. But prominent difference was not observed in the bodyweight of both the age groups when compared with ICMR (2020). This finding shows that the selected sprinters were 'fit' in terms of bodyweight though shorter than ICMR counterparts

Similar studies were reported by Anel and Subapriya (2014) that revealed that the average height of male Thang-Ta athletes in the age category of 15-19 years from two different training centres was 160.38 cm and 157.48 cm, respectively, and their average weight was 53.50 6.81 kg and 49.225.35 kg respectively.

According to a research done by Anup *et al* In 2014 on track and field athletes of Bangladesh and concluded that low athletic performance may be owing to deprived anthropometric characteristics and also stated that the poor performance of Indian Sports persons might be due to inadequate anthropometric qualities, which supports the relevance of anthropometric factors in sports performance.

4.4.1.2 Body Mass Index(BMI)

Table XV represents the distribution of the selected athletes according to BMI classification recommended for women by WHO (2020).

Table XV Body Mass Index classification of the selected Sprinters

n=60

Category	BMI*	No. of subjects	Per cent
Underweight	<18.5	13	21.7
Normal	18.5-22.9	27	45
Overweight	23-24.9	5	8.4
Obese	>25	15	25

*WHO (2020).

From the Table XV, It was found that 45 % of the selected sprinters were in the normal range of Body Mass Index namely 18.5 to 22.9. Twenty one per cent of sprinters were underweight and had body mass of less than 18. Out of the 33.4 per cent of the sprinters who had body mass index greater than 23, Twenty five per cent were in obese category. The finding that females reported increased body mass and BMI following the lockdown during COVID-19, which might be related to decreased physical activity and dietary changes. Similar findings were reported by Tsoukos and Bogdanis (2022) stating that The COVID-19 lockdown (year 2020–2021) had a detrimental impact on both boys' and girls' body mass and BMI, as well as lower body fitness test measures, when compared to preceding classes (2016–2017 and 2018–2019). Vasanthamani and Uma Mageshwari (2009) found that private University students of the same age had higher BMI values and a higher prevalence of obesity in a research. Studies carried out by Chatterjee *et al* (2006) revealed that the BMI of university level male track and field players in South India fell within the normal recommended range, showing that all of the athletes were non-obese and fit to participate in sports. figure 12 represents the BMI of the selected athletes in the present study.

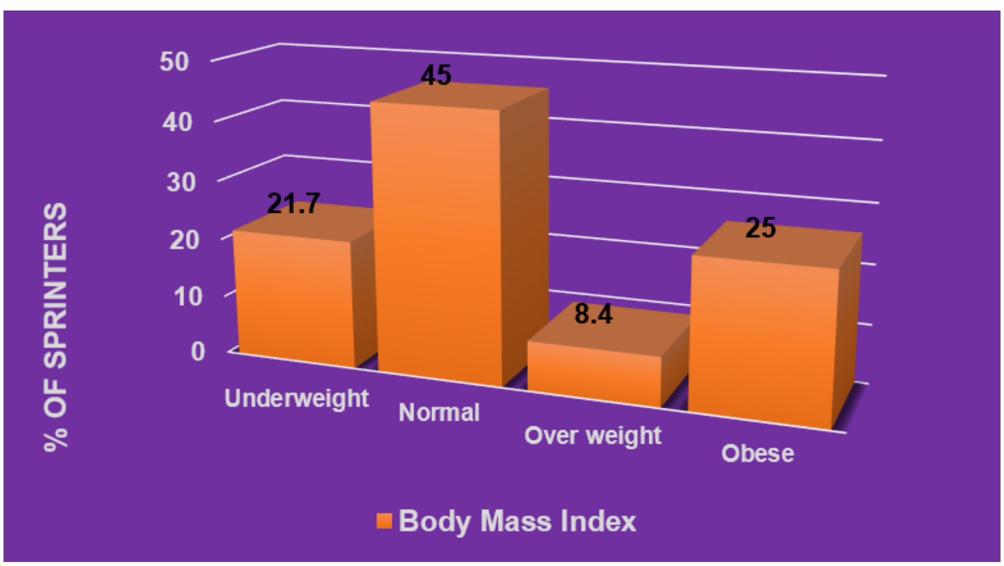


Figure 12

Body mass index of the selected sprinters

4.4.1.3 Waist and Hip Circumference

The waist and hip circumferences of the selected sprinters were analysed and waist to hip ratio was calculated. the mean waist and hip circumferences and waist to hip ratio of the selected sprinters were presented in table XVI.

Table XVI Mean Waist and Hip Circumferences and Waist-Hip Ratio of The Selected Sprinters

n=60

Parameters	Mean ± S.D
Waist circumference	67.97 ±11.35
Hip circumference	86.66 ±13.98
WHR	0.80 ±0.04

From the above Table, it was found that the mean waist-hip ratio was in the normal range (< 0.85) suggested for women by NFHS (2020). Accumulation of fat in the hip or waist was not found as these sprinters had regular physical activity. Hence there was no abdominal obesity.

Anel and Subapriya (2016) studied the nutritional anthropometry among Thang-Ta athletes showed a waist circumference range of 63 and Hip circumference range of 85 and the waist-hip ratio within the normal range of 0.8.Similar studies conducted by Kaur *et al* (2011) among 21 to 30 year old women in Ludhiyana stating that the waist circumference ranged from 66 to 116.8cm .

4.4.1.4 Mean Skinfold Thickness of the Selected Sprinters

The Mean skinfold thickness of the selected Sprinters were measured and presented in Table XVII. Figure 13 also shows the waist, hip circumferences and waist-hip ratio.

Table XVII Mean Skinfold Thickness of the Selected Sprinters

n=60

Skin Fold (mm)	17-20 Years Sprinters
Triceps	9.45±1.10
Biceps	7.66±1.41
Subscapular	12.52±1.91
Supra iliac	13.01± 1.42

The mean triceps, biceps, subscapular, supra iliac, sprinters in the age group of 17-20 years was found to be 9.45±1.10mm, 7.66±1.41 mm, 12.52±1.91mm, 13.01±1.42 mm respectively, which falls under adequate calorie reserve as compared to reference value suggested for females by Douglas *et al.,* (2008). The mean skinfold thickness is found greater in the supra iliac region could be due to fat deposition in the abdominal area for females. This is due to the fact that women have a higher percentage of body fat in the subscapular, suprailiac, and abdominal regions than men (Blaak, 2001).

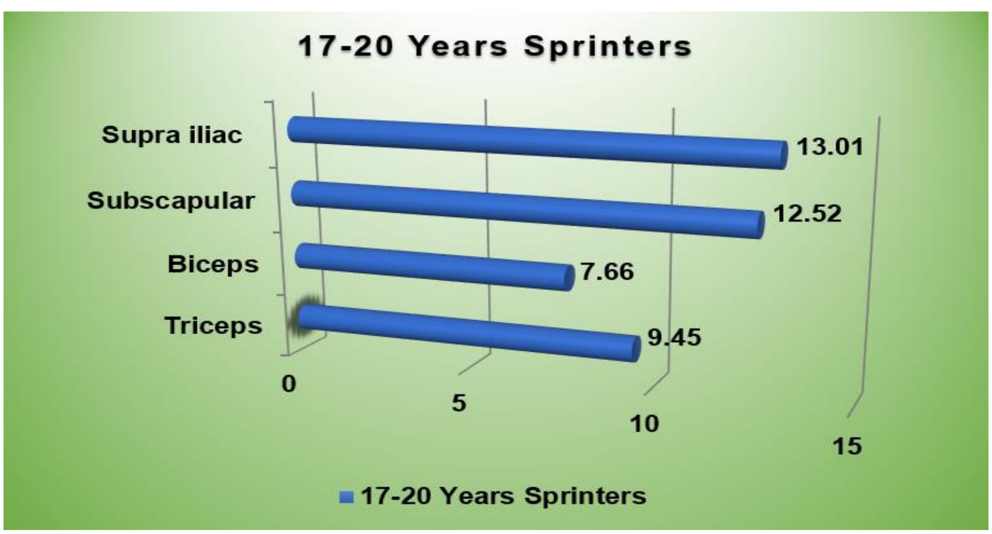


Figure 13

Mean Skinfold Thickness of Selected Sprinters

4.4.1.5 Body Composition and BMR of the Selected Sprinters

Mean body composition and BMR values of selected sprinters were presented in Tables XVIII.

Table XVIII Mean Body Composition and BMR of the Selected Sprinters

n=60

Body Composition Parameters	Referral range	17-20 Years Sprinters (n=60)
WHR	0.70-0.80	0.81±0.03
Fat %	18-28	31.12±8.30
Fat free mass(kg)	34-43	37.46±4.06
Total body water(kg)	25-31	27.60±3.02
Fat mass(kg)	10-15.9	16.89±9.49
Skeletal Muscle Mass	18.7-22.9	19.96±2.93
Lean body mass(kg)	32-39.5	35.23±3.68
BMR (kcal)	1126-1294	1184.30±87.58

The mean score of Waist Hip ratio, Body fat Per cent, total body water, free fat mass, fat mass, Skeletal Muscle Mass, lean body mass and BMR of the selected sprinters in the age group of 17-20 years were found to be 0.81±0.03, 31.12±8.30

kg, 37.46±4.06 kg, 27.60±3.02 kg,16.89±9.49 kg,19.96±2.93 kg ,35.23±3.68 kg, 1184.30±87.58 kcal respectively.

From the present research, it was observed that the mean Body Fat percent of selected sprinters were not in the recommended range. The rise in the fat mass among the sprinters might be due to the Covid 19 lockdown. Studies have reported that the Covid 19 lockdown negatively affects sprinters' body composition owing to inactivity.

According to the American College of Sports Medicine 2008, Non-athletes should have a body fat percentage of 15-18%, whereas sprinters should have a body fat percentage of less than 10% (depending on the sport) (good category) (Thomson *et al.,* 2010).

According to NFHS (National Family Health Survey 5 2019-2020 , Obesity is on the rise in both men and women in every state. Overweight or obese women and men between the ages of 15 and 49 have grown in virtually every state (except Gujarat and Maharashtra). Nearly one-third of men and women (aged 15 to 49) in Goa, Andhra Pradesh, Karnataka, Kerala, Telangana, and Himachal Pradesh are overweight or obese. Yasuda *et al.,* (2021) stated that the effect of covid 19 lockdown on COVID-19's two-month home stay has a detrimental impact on women's fat mass, but not their Fat Free Mass or men's Fat Mass.

Shete *et al.,* (2014) found that athletes had a mean body fat percentage of 24.11 percent. Derbyshire (2011) gathered pre-and post-season body composition measures at the University of Texas and discovered that athletes had 22.3 percent body fat at the start of their careers.. Vasanthamani and Anuradha (2011) found a body fat percentage of 19.29 among female athletes aged 18 to 23 In Coimbatore, Tamilnadu,

When compared to the standard off-season values, the COVID-19 quarantine has been shown to enhance Fat Mass and body mass (BM) while decreasing sprint and counter movement leap skills in Brazil (professional soccer athletes) (Grazioli et al 2020). As a result, studies have revealed that tracking body composition data is critical for sprinters to maintain and improve their performance.

Figure 14 represents the Mean Body Composition of the selected Sprinters.

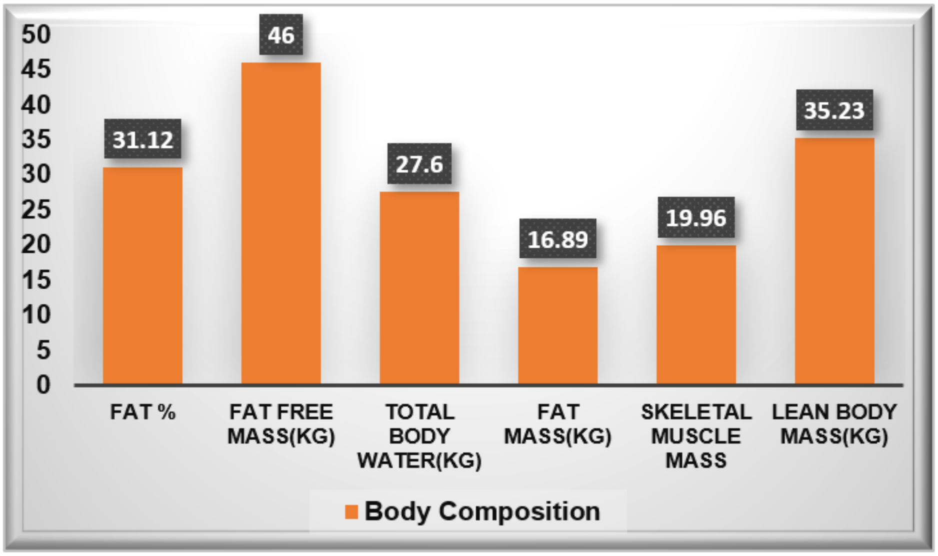


Figure 14

Mean Body Composition of the selected Sprinters

4.4.2 Biochemical, Clinical examination and Medical history

4.4.2.1 Mean Biochemical Parameters of Selected Sprinters

Table XIX represents the mean Hemoglobin, Blood glucose, and Mean serum lactose dehydrogenase levels of selected sprinters.

Table XIX Mean Biochemical Parameters of Selected Sprinters

n=60

Parameters	Level	Referral range
Haemoglobin(g/dl)	11.34±1.44	12-15*
Blood Glucose (mg/dl)	85.88±10.16	70-140**
LDH (U/L)	195.38±31.98	140- 280***

*National Cancer Institute, ** American Diabetic Association,
*** American Association of Clinical Chemistry

Results on the biochemical parameters of the selected sprinters revealed that the mean hemoglobin (11.34 g/dl) was slightly lower than the referral range of normal hemoglobin 12-15g/dl (Nation Cancer Institute (NCI). Blood glucose and serum Lactose Dehydrogenase (LDH) of selected sprinters were within the referral range of 70-140 (American Diabetic Association) and 140 to 280 U/L (American Association for Clinical Chemistry) respectively. Poor dietary intake of iron, irregular menstruation and the decrement in the hemoglobin content of the selected sprinters could be due to the causative factors such as lack of knowledge of iron rich foods and poor purchasing power due to low family income and also could be due to Covid 19 pandemic.

Hariyanto et al, (2020) conducted a review on Severe coronavirus disease 2019 (COVID-19) infection is linked to anaemia. Anemia appears linked with an increased risk of severe COVID-19 infection, according to a meta-analysis

According to the World Health Organization, one out of every two women in the world is iron deficient. Athletes may have unbalanced diets while attempting to achieve a certain body weight or body composition, and the inflammation induced by frequent exercise can also inhibit efficient iron uptake from food. As a result, female athletes are at a higher risk of iron deficiency anemia (Pasricha *et al.,* 2014).

According to NFHS-5 Phase II Findings released by Union Health Ministry (2021) Anaemia in children and women is a source of concern. In all phase-II States/UTs and across India, more than half of children and women (including pregnant women) are anaemic compared to NFHS4, despite a significant rise in the composition of iron folic acid (IFA)tablets taken by pregnant women for 180 days or longer.

Athletes' haemoglobin concentrations are typically lower than the general population, resulting in "sports anaemia." Increased dietary requirements, dietary restrictions, reduced absorption, and aerobic exercise causes higher energy losses induce sports anaemia. Anemia in athletes requires a comprehensive strategy that includes bioavailability of iron. In order to have a healthy gut microbiota, which regulates iron status, iron-depleted athletes increased their iron status and, presumably, physical performance (Damian *et al.,* 2021).

Food- to-food fortification is a promising technique to tackle the highly widespread problem of iron deficiency and anemia in vulnerable groups (Jain, 2013). (Jain, 2013). According to Tandon (2002), the transition from "pill" to "natural food" is challenging, but it is the best and most natural solution to India's iron deficiency problem.

4.4.2.1 Clinical Signs and Symptoms Among Sprinters

The details regarding the clinical assessment of the selected sports persons are summarized in Table XX.

Table XX Clinical Signs and Symptoms Among Sprinters

N=140

Symptoms*	Number	Percentage
Dental caries	10	7
Pale skin	55	39.5
Pigmentation of nails	56	40
Dizziness and giddiness	48	34
Poor appetite	30	21.5

* Multiple responses

Functional limitations can have a negative impact on sprinters' performance at both the individual and societal levels. Physical functioning can be affected by dysfunction or structural abnormalities. Clinical signs and indications of sprinters were measured in terms of Dental caries, pigmentation of nails, pale skin, dizziness and giddiness, and poor appetite. Of the 140 sprinters, only 7 percent had dental caries. About 39.5 % of sprinters had pale skin, and coloration of nails were found in 40 % of sprinters, while 34 % of subjects were reported to suffer from dizziness and giddiness. poor appetite was reported by 21.5 % of sprinters.

Kaur (2011) found similar results, revealing that 64% of female individuals felt fatigued and weak. Shortness of breath was experienced by around half of the participants. Four percent of the participants said they had lost their appetite. The feeling of weakness was experienced by 34% of participants, while dizziness was noted by 10%. Dizziness, faintness, weight loss, low appetite, and other signs of anaemia, according to Dwumfour (2013).

Figure 15 represents the Clinical signs and Symptoms among Sprinters.

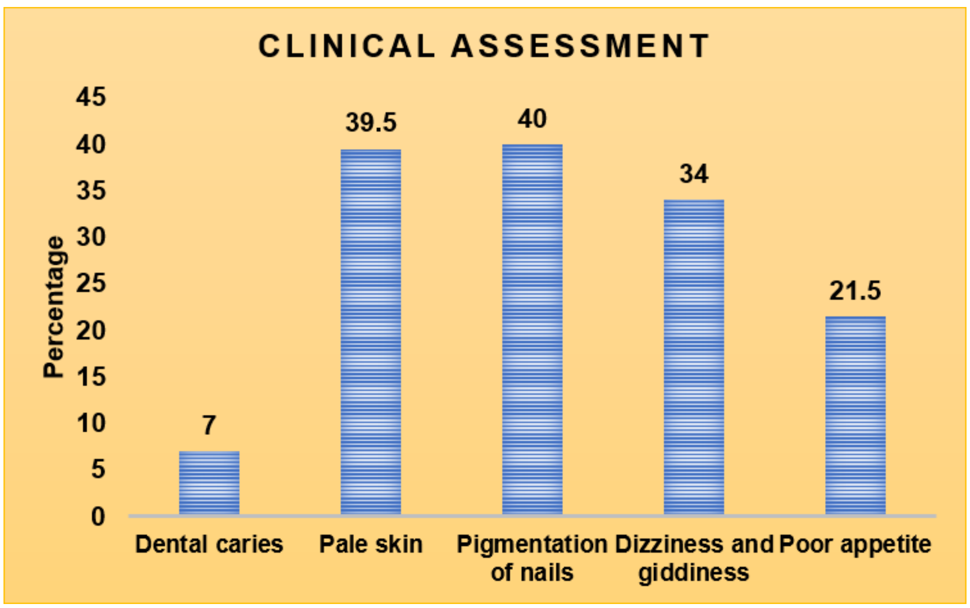


Figure 15

Clinical Signs and Symptoms Among Sprinters.

4.4.2.2 Medical History of the Sprinters

4.4.2.2.1 Family History of the Sprinters

History of disease prevalence in the families of the sprinters is presented in table XXI

Table XXI: Family History of the Sprinters N=140

Symptoms	Number	Percentage
Hypertension	24	17
Diabetes	30	21.5
Asthma	10	7.5
Heart disease	16	11.5
Cancer	11	8
Obesity	25	18
Nil	24	17.14

From the survey, It was found that out of 140 families of 21.5 per cent of families reported diabetes,17 per cent hypertension, 11.5 per cent heart disease and 7.5 % asthma, 18 per cent obesity and 8 % cancer among their family members. 17 per cent of sprinter reported no disease prevalence in their families.

4.4.2.2.2 Ailment / Morbidity Among Sprinters

Details on ailment/morbidity among the sprinters are presented in Table XX1I.

Table XXII: Details of Ailments / Morbidity Among Sprinters (N=140)

Symptoms	Number	Percentage
Jaundice	5	3.5
Chest pain during exercise	6	4.5
Fracture	15	11
Allergy	-	-
Asthma	5	3.5
No Ailment	109	77.85

The distribution of sprinters by morbidity status indicated the that out of the 140 sprinters only 3.5 per cent, 4.5 per cent, 11 per cent and 3.5 per cent had jaundice, chest pain during exercise, fracture and asthma in the past respectively. none of sprinters reported allergy. No ailment in the past six months reported by 77.85 per cent of sprinters.

4.4.3 Dietary and Life Style Patterns

4.4.3.1 Dietary Patterns

Adolescents' growth and development are influenced by their diet, and the formation of appropriate eating habits is critical during this time. In this age range, there is a dual burden of undernutrition and overnutrition.

Details of dietary pattern of sprinters are presented in Table XXIII.

Table XXIII Details of Dietary Pattern of Sprinters

N=140

Women Sprinters		
Details	**No.**	**%**
Nonvegetarian	102	72.85
Vegetarian	38	27.14
On rising		
Tea	32	22.85
Coffee	16	11.42
Milk	29	20.71
Water	63	45
Frequency of Meals/day		
2 times	42	30
3 times	98	70
Skipping No	140	100
Variety in diet		

Every day	64	45.71
Sometimes during a week	43	30.71
During the weekend days	33	23.57
Food Allergy		
Yes	-	-
No	140	100
Type of Food before Competition		
Solid	27	19.28
Semisolid	47	33.57
Liquid	**66**	**47.14**

The meal pattern of the individual depends upon the family and the community to which they belong, the food habits of the sprinters revealed that 73 percent of the sprinters were non-vegetarians whereas 27 per cent of the Sprinters were vegetarians. Among sprinters majority 22.85 per cent sprinters consumed tea and 20.71 percent sprinters consumed milk in the morning remaining 11.42 per cent and 45 per cent consumed coffee and water respectively. It was found that sprinters had very little intake of coffee. 70 % of the subjects reported consumed 3 meals a day while 30 % of the subject consumed two meals a day. It was also found that all the sprinters did not skip meals. Majority 45.71 per cent male and 86.9 per cent sprinters had variety in their diet every day. 30.7 per cent sprinters consumed variety of diet, sometimes during a week and only 23.57 per cent sprinters had variety in diet during the weekend. Among the sprinters none of the them had food allergy. Majority 47.14 sprinters consumed liquid food before competition. Remaining 33.57 per cent and 19.28 percent sprinters consumed semisolid and solid food before competition respectively.

Several researchers have revealed that dietary patterns among adolescents such has Snacking, mainly on high-energy foods; meal skipping, especially breakfast; frequent usage of fast food; and a poor intake of fruits and vegetables are all prevalent (Kaushik, 2011; Kotecha *et al.,* 2013). Vegetarian diets have been associated with several health benefits including low mortality and morbidity from life style disorders (Key *et al.,* 2006; Kontogianni *et al.,*2008; Berkow and Barnard, 2006)

4.4.3.2 Life style Pattern of Sprinters

Table XXIV represents the life style pattern of sprinters

Table XXIV Lifestyle Pattern of Sprinters N=140

Lifestyle Pattern	No.	%
Duration of Exercise(hours)		
>1/2	**140**	**100**
<1/2	**-**	**-**
Alcohol /smoking	**-**	**-**
Yoga	**18**	**12.85**
Sports	**76**	**54.28**
Music (listening)	**20**	**14.28**
Book (reading)	**26**	**18.57**

Among the sprinters all the 140 (100 %) sprinters performed exercise for more than ½ hour. None of the sprinters were alcoholics or smokers. listening to music was adopted as a stress control method by sprinters, 18.57 per cent of sprinters read books to alleviate mental stress. while 54.28 per cent and 12.85 per cent play sports and yoga to control their mental stress respectively.

As widespread effects of COVID-19 pandemic on the lifestyle of people around the world has effected adviresly the health status of most of the people, Sprinters exercised less often and for shorter periods of time, which might have had a role in the link between depression, anxiety, and stress.

According to Kantibera et al (2011) Children and adolescents with healthy eating habits and an active lifestyle are less likely to develop chronic illnesses and die young, lowering healthcare expenses and improving their quality of life.

Childs *et al.,* 2021 investigated sleep and mental health in athletes during the COVID-19 pandemic lockdown and discovered that the Multiple lifestyle variables were interrupted by the COVID-19 pandemic lockdown, which may have contributed to the documented increase in difficulty falling asleep (sleep latency), increased daytime tiredness, and associated links to lower mental health.

4.4.3.3 Food Frequency Pattern of The Sprinters

The frequency of consumption of different foods by sprinters is given in Table XXV

Table XXV Food Frequency among Sprinters

(N=140)

Food Item	**Daily**	**Weekly once**	**Weekly Twice**	**Weekly Thrice**	**Fort nightly**	**Monthly**	**Occasionally**	**Never**
	Cereals							
Rice %	100	-	-	-	-	-	-	-
Wheat	15	40.71	32.85	11.42	-	-	-	-
Maize	-	-	-	-	18.57	12.14	57.85	7.14

Pulses								
Peas	-	26.4	27.14	3.57	16.42	22.85	-	3.57
Bengal gram	-	-	46.42	53.57	-	-	-	-
Black gram	-	72.8	16.1	-	-	11.1	-	-
Green gram	-	19.7	14.2	-	-	35	31.1	-
Red gram	-	63.6	-	-	-	17.8	18.6	-
Soybean	-	36.5	7.1	-	-	35.7	20.7	-
Rajmah	-	14.3	-	-	10	53.5	22.2	-
Green leafy Vegetables								
Amaranthus	-	24.3	25.7	-	14.3	19.6	7.2	8.9
Cabbage	-	24.3	21.1	31.4	14.3	8.9	-	-
Curry leaves	100	-	-	-	-	-	-	-
Coriander leaves	100	-	-	-	-	-	-	-
Spinach leaves	-	-	51.8	24.5	7.5	5.5	10.7	-
Mint leaves	-	-	14.3	21.1	24.3	31.4	8.9	-
Other Vegetables								
Potato	100	-	-	-	-	-	-	-

Onion	100	-	-	-	-	-	-	-
Snake gourd		11.9	26.2	17.9	-	20.2	23.8	-
Bottle gourd	-	-	21.4	11.9	-	27.4	39.3	-
Cauliflower	-	-	16.6	13.1	22.7	33.3	14.3	-
Plantain	-	-	-	52.5	23.2	24.3	-	-
Beans	-	17.9	26.2	13.1	13.1	11.9	17.8	-
Ladies finger	-	44.1	32.1	23.8	-	-	-	-
Condiments and Spices								
Garlic	100	-	-	-	-	-	-	-
Ginger	100	-	-	-	-	-	-	-
Turmeric	100	-	-	-	-	-	-	-
Fruits								
Amla	-	-	-	5.77	50	19.23	25	-
Banana	-	26.2	27.4	46.4	-	-	-	-
Orange	-	-	-	21.4	40.5	38.1	-	-
Guava	-	-	-	36.41	37.14	26.42	-	-
Tomato	100	-	-	-	-	-	-	-
Meat, Fish and Poultry								

Fish	-	10.72	-	-	37.14	-	25.	27.14
Mutton	-	38.57	-	-	29.29	-	-	32.14
Chicken	-	41.5	13.57	15.8	-	-	-	29.13
Egg	50	12.85	10	-	-	-	-	27.14
Milk and Milk products								
Milk	84.28	-	-	15.72	-	-	-	-
Curd	60	-	20	20	-	-	-	-
Paneer	-	-	-	-	78.57	13.58		7.85
Fats and oils								
Oil	100	-	-	-	-	-	-	-
Sugar and Jaggery								
Sugar	100	-	-	-	-	-	-	-

From the table, it was found that all the sprinters consumed rice daily. The majority 40.71 per cent consumed wheat once a week and the remaining 15% percent, 32.85 per cent and 11.42 per cent consumed daily, twice and thrice in a week respectively; maize consumption was very low among sprinters, majority (57.85) of sprinters consumes maize occasionally; 38.88 per cent sprinters consumed pulses once in a week, 22.19 per cent (twice in a week); 28.57 per cent thrice in a week. Among green leafy vegetables Curry leaves, Coriander leaves were consumed daily as it is used in most of the recipes. Amaranthus, Cabbage, Spinach leaves, Mint leaves were the other green leafy vegetables consumed by the sprinters; 24.3 per cent consumed vegetables once a week; 28.22 per cent sprinters consumed twice a week, 25.66 per cent consumed thrice in a week, 15 per cent consumed fortnightly, 16.3 percent consumed occasionally and 8.93 percent consumed monthly according to the availability of the green leafy vegetables. Among other vegetables potato and onion were consumed daily. Snake gourd, bottle gourd, cauliflower, plantain, beans, ladies' finger were consumed once in a week (24.63 per cent), twice in a week (24.5 per cent), thrice in a week (22.05 per cent) and fortnightly (19.66 per cent). 23.42 per cent sprinters consumed other vegetables on monthly basis and 23.8 percent sprinters consumed other vegetables occasionally according to the availability of the vegetables. Among spices and condiments, garlic, ginger and turmeric were consumed daily as it is used in the recipes very often. Among fruits tomato was consumed daily by sprinters, banana was frequently consumed since it is available in all seasons. Consumption of other fruits were very less. This might be due to the availability and the cost of the fruits. 42.54 per cent, 27.91 per cent and 25 per cent sprinters consumed fruits fortnightly, monthly and occasionally respectively. 50 per cent of the sprinters consumed egg daily and 12.85 per cent and 10 per cent consumes once in a week and twice in a week. 27.14 per cent of sprinters were never consumed egg. Most of the sprinters consumed chicken (41.5 per cent) and mutton (38.5 per cent) once in a week. While 10.2 per cent of the sprinters consumed fish once in a week, 13.57 per cent and 15.8 percent sprinters consumed chicken twice a week and trice in a week respectively. 29.13 percentage of sprinters were never consumed chicken. 37.14 per cent consumed fish fortnightly and 25 per cent consumed occasionally, while 27.14 sprinters never consumed fish. Since Majority of sprinters consumed mutton once in a week. 29.29 per cent fortnightly, 32.14 per cent monthly of sprinters were never consumed mutton. Majority (60 per cent) consumed daily,20 per cent consumed twice in a week and 20 per cent consumed trice in a week. Consumption of paneer was very poor among the sprinters. 78.57 per cent consumed paneer fortnightly, 13.58 per cent consumed monthly, while 7.85 percent sprinters never consumed paneer. Oil and sugar were consumed by all the sprinters daily. The limited access to daily groceries during the covid 19 Lockdown may cause people to eat less fresh food, particularly fruits, vegetables, and meat or fish.

4.4.3.4 Mean Food Intake of Women Sprinters

The Mean Food intake of sprinters is presented in Tables XXVI**.**

Table XXVI: Food Intake pattern of the Women Sprinters

N=140

Food	*Suggested Allowances	Actual Intake	Percentage Deficit
Cereal and millets (g)	400	341.69±67.36	-14.5%
Pulses and legumes (g)	40	36.05±26.71	-9.8
Root and tubers(g)	150	31.17±29.16	-79.22
Fruits (g)	150	139.64±125.17	-6.9
Milk and milk products (ml)	750	95.17±137.48	-87.31
Meat (g)	250	55.71±124.81	-77.71
Fats and oil (g)	50	7.07±3.13	-85.88
Sugar (g)	80	1.82±6.60	-98.1

Satyanarayana et.,al 1985 ; * ILSI,NIN and SAI (2007)

Average food intake of the sprinters was compared with the suggested food allowance of foodstuff by the International Life Science Institute, NIN and SAI (2007) for the specific event. The average daily consumption of several food categories was found to be of Cereal and millets (-14.5 %), Pulses and legumes (g) (-9.8 %), Root and tubers (-79.22 %), Fruits (-6.9 %), Milk and milk products (-87.31 %) Meat (g) (-77.71 %), Fats and oil (-85.88 %), and Sugar (-98.1 %), were deficient and determined to be insufficient, as evidenced by their poor nutritional profiles. This might be due to the impact of the Covid 19 lockdown.

Results of the study shows that the selected participants were not getting even the servings recommended. Poor diet can actually lead to poor performance. After several tiring sessions of training, sports persons can damage their sports performance because of their poor dietary practices. Sports people need more nutrients than less active individuals.

According to Committee on World Food Security (2020) stated that during lockdown Food supply chain disruptions, income and livelihood losses, rising inequality, social assistance programme disruptions; changed food environments; and inconsistent food costs in localised settings leading to low food intake and poor nutritional profiles are among the overlapping and reinforcing dynamics that affect food systems, food security, and nutrition.

Nutrition not only affects performance, but it may also assist avoid injuries, improve exercise recovery, manage body weight, and improve general health. All athletes should have a strong working knowledge and grasp of exercise science and sports nutrition in order to maximise their individual performance potential (Bakulin and Efimo, 1996; Loucks, 2004).

4.4.3.5 Macronutrient and Micronutrient Intake of the Women Sprinters

The amount of nutrients consumed by athletes affects their performance and capacity to compete. Lack of education, tight schedules, and food availability are all obstacles to proper nutrition.

The details regarding the macronutrient and micronutrient intake of the women sprinters in Table XXVII and XXVIII

Table XXVII Macronutrient Intake of the Sprinters

N=140

Nutrients	Recommended Allowance (ILSI,NIN and SAI, 2007)	Actual Intake	Percentage Excess/ Deficit
Energy (kcal)	3147.6	2400.85±285.58	-23.72
Carbohydrate (g)	435.4	322.57±61.74	-25.91
Protein (g)	131.2	45.80±15.01	-65
Fat(g)	110.2	35.38±10.55	-67.9

From the above table it was found out that the mean energy, CHO , protein and fat intake of sprinters was found to be 2400.85±285.58 kcal, 322.57±61.74 g, 45.80±15.01 g, 35.38±10.55 g respectively. All the macro nutrient intake was deficit when compared to the Recommended Allowance ILSI, NIN and SAI (2007), energy intake was 23.72 per cent deficit, carbohydrate 25.91 per cent deficit, and protein 65 per cent deficit and fat 67.9 per cent deficits. Therefore the nutrient intake was inconsistent.

The findings of the Ghloum and Hajj, (2011) on diet consumption on Kuwaiti fencers showed that They consume 47.8 percent 1.7 of total calories per day less carbohydrate, 16.5 percent.84 more saturated fat, and 16.6 percent.80 more total protein than suggested.

Table XXVIII Micronutrient Intake of the Sprinters

N=140

Nutrients	Suggested allowance ICMR 2020	Actual Intake	Percentage Excess/ Deficit
Thiamine (mg)	1.7	0.97±0.40	-42.94
Riboflavin(mg)	2.3	0.66±0.31	-71.30
Niacin (mg)	17	11.65±4.67	-64.47
Vitamin C (mg)	68	33.22±23.46	-51.14
Iron(mg)	32	11.78±5.80	-63.18
Calcium(mg)	1050	358.10±221.10	-65.89
Vitamin A(mg)	800	271.34± 523.45	-66.08

Using the ICMR's (2020). dietary composition table, the mean micronutrient intake of various nutrients per day was determined from the food consumption. It was observed that, the mean intake of women sprinters in the age group of 17- 20 years on thiamine was deficient by 42.94 per cent, riboflavin was deficient by 71.30 per cent, niacin was deficient by 64.47 per cent, vitamin c was deficient by 51.14 per cent, iron was deficient by 63.18 per cent, calcium was deficient by 65.89 per cent and beta carotene was deficient by 66.08 percent respectively.

This insufficiency of nutrients would affect the physique and body reserves of sports persons which in turn will affect the performance of sports persons. The significance of the connection between nutrition and physical performance is obvious. sufficient growth and development require proper nourishment. Sprinters require proper diet to recover from sessions and contests. An sufficient food intake is critical for sprinters to maintain proper nutritional status, optimal performance, and recuperation, as well as to reduce the health hazards connected with regular high-intensity activity. (Brouns, 2003)

Carbohydrates with protein can boost muscle protein absorption after exercise. Muscles are extremely insulin sensitive after exercise (Holloszy, 2005). As a result, boosting insulin production by taking carbs together with protein might enhance protein absorption into muscle cells even more. Furthermore, carbohydrate supplementation enhances muscle glycogen resynthesis (Tarnopolsky*et al.,* 2005). Tipton (1999) concluded that eating protein and carbs together is a sufficient stimulus for muscle anabolism.

4.4.3.6 Mean Energy Intake and Expenditure of Selected Sprinters

The mean energy intake and expenditure of the sprinters is given in Table XXIX.

Table XXIXI Mean Energy Intake and Expenditure of Sprinters

N=140

Category	Actual Intake/day	Energy Expenditure	% excess/deficit
Sprint Sprinters (17-18 yrs)	1982.90± 285.60	2271.34±240.89	-14.54
Sprint Sprinters (19-20 yrs)	1994.35± 276.27	2266.99±231.89	-13.67

From the above data, it was shown that the mean energy expenditure of women sprinters in the age group of 17-18 years was 2271.34 kcal /day with an excess energy expenditure of 14.54 per cent against the actual intake 1982.90 kcal /day. Similarly, the mean energy expenditure of Women sprinters in the age group of 19-20 years was 2266.99 kcal /day with an excess energy expenditure of 13.67

per cent against the actual intake of 1994.35 kcal /day. Both the age groups were at energy deficit levels.

The major cause of the respondents' low energy intake might be poor dietary habits and a lack of nutrition awareness, harmful food choices, a lack of the components of a well-balanced diet, and the effects of nutrition on performance. Coaches frequently consider adequate nutrition solely during their sport's season. In fact, adequate diet is essential at all times for efficient sports performance. Sprinters, coaches, athlete trainers, and strength and conditioning experts should all get correct nutrition programming.

The findings of this study differed significantly from those of Martin *et al.,* (2006), who investigated the food habits and physical activity of elite English female soccer players. Energy expenditure (2153) did not differ substantially from intake ($p>0.05$), indicating that energy balance was attained.

Reduced calorie intake and rigorous exercise, according to Souza and Williams (2004), causes hypoestrogenism, which is linked to clinical symptoms such as disordered eating, stress fractures, osteoporosis, and, as recently documented, an increased risk of early cardiovascular disease. Energy deprivation is directly connected to the genesis of menstruation irregularities in women.

The findings of this study are also consistent with those of Prajakta *et al.,* (2010), who found that swimmers were unable to satisfy their energy demands, resulting in a negative impact on their cardiopulmonary fitness. The demand for sufficient energy to carry out sports activities was substantially connected with cardio respiratory fitness and calorie consumption. Nande et al (2008) found that 100% of female and male athletes in various sports disciplines had a negative energy balance.

4.4.3.7 Physical Performance of the Sprinters

The mean energy intake and expenditure of the sprinters is given in Table XXX.

Table XXX Mean Physical Performance Assessment of Selected Sprinters

N=60

Parameter	***Scoring**	**Mean ± S.D (n=60)**
30m acceleration(s)	Good-4.5-5.0 Average-4.2-4.5	6.19±0.67
60m Dash(s)	Good-6.52	11.83±1.73
Sit-Ups	Good-37-41 Average-29-32 Fair-25-28	36.83±16.74
Ruler Drop Test(cm)	Excellent-<7.5, A.Ave-7.5-15.9 Average-15.9-20.4 Poor-.28cm	9.89±4.26
Margaria Kalamen Test (Watts)	Good-1491-1785 Average-1187-1481 Fair-902-1177	901.92±85.26
standing long jump (cm)	Good-156 Average146 Fair-135	140.50±20.81
Hexagon Agility Test (sec)	Excellent <5 Very good- 6-10 Good-12.9 Fair- 16-20	16.53±2.73

* Methodologies for Fitness Assessment Field Test (Ray *et al.,* 2011)

The mean value for 30m acceleration of selected sprinters of 17-20 years of age was 6.19±0.67cm, the selected sprinters were in the poor range for 30 m acceleration when compared with referral scoring. The mean value for 60 m dash among selected women sprinters 17-20 years of age was 11.83±1.73 cm which was in the poor category when compared with the classification by Methodologies for Fitness Assessment Field Test (Ray *et al.,* 2011). The mean sit ups values were 36.83±16.74 counts per minute. All the sprinters were in the above average category in terms of sit-ups according to the standard norms. The mean ruler drop score of selected sprinters was 9.89±4.26 cm, the mean is within above average category when compare to the referral data. The average score of standing broad jump was 140.50± 20.81 cm. All the selected sprinters were in the fair category when compared to the referral standards. The average margaria Kalamen test score was 901.92±85.26 cm. When compared to standards, all the selected women sprinters were in the fair category. The mean score of hexagon agility test was 16.53± 20.73 sec. All the selected sprinters were in the fair category when compared to the referral standards.

Throughout the world, COVID-19 has caused the closure of gyms, stadiums, pools, dance and fitness studios, physiotherapy centres, parks, and playgrounds. As a result, many people were unable to participate in their typical sports or physical activities outside of their homes, whether solo or in groups. As a result of these circumstances, many people become less physically active, spend more time on screens, have irregular sleep patterns, and consume poor diets, resulting in weight gain and a loss of physical fitness.

The above findings and the huge deficits in food and nutrient intakes indicate the need for an intensive and multifaceted nutrition intervention in terms of food supplementation (providing wholesome and balanced diet) and nutrition education for sustained enhancement of nutritional status. The situation also calls for an equally intensive training regimen which will help to improve the performance caliber of the sprinters especially during the covid 19 pandemic.

Phase V

4.5 Effect of Supplementation of Nutribar on Physical performance of the Selected Sprinters

4.5.1 Effect of Intervention on Sprinters

4.5.1.1 Effect of Intervention on Anthropometric Measurements

Table XXXI presents the impact of supplementation on Anthropometric Measurements of women Sprinters.

Table XXXI Impact of supplementation on Anthropometric Measurements

Parameter	Referral range*	Mean ± S.D Experimental Group (n=29)			Mean ± S.D Control Group (n=30)		
		Before	After	t value	Before	After	t value
Height (cm)	162	158.88±5.30	159.43±5.24	6.824**	155.94±5.24	156.26±5.20	3.739**
Weight (kg)	55	55.88±13.16	55.12±12.40	2.293*	54.12±10.23	54.17±10.10	0.219^{NS}
BMI (kg/m	21	21.99±4.67	21.65±4.38	2.038*	22.21±4.24	22.20±4.02	0.619^{NS}

*** Significant at p<0.05 level, ** Significant at p<0.001 level, NS= Not Significant**

***ICMR 2020**

The mean weight, height and BMI were analysed for pre and post the intervention with the use of standard procedures. The data revealed that the mean values of experimental groups before supplementation was 158 cm and after supplementation it was recorded as 159 cm. whereas the mean height of control women sprinters before intervention was 155.94 cm and after intervention recorded as 156 cm.

Average weight of women sprinters of experimental group before supplementation was 55.88 kg and after supplementation it was recorded a weight of 55.12 kg, whereas the mean weight of control group before the nutritional intervention was 54.12 kg to 54.17 kg after intervention. Before supplementation the mean BMI values of women sprinters of experimental group was 21.99 kg/m2 and after supplementation it was recorded as 21.65 kg/m2. Before intervention the mean BMI values of control group was ranged from 22.21 kg/m^2 and it was recorded as 22.20 kg/m2 after intervention.

Niels Uth in his 2005 study compared the anthropometry of world-class sprinters and people belonging to the normal population and found out that all of the women sprinters were in the height range of 1.52-1.82cm. In the present study the selected female sprinters' heights (an average of 1.57m) was also observed to be in this range.

Figure 16 represents the Impact of supplementation of Nutribar on Anthropometric Measurements

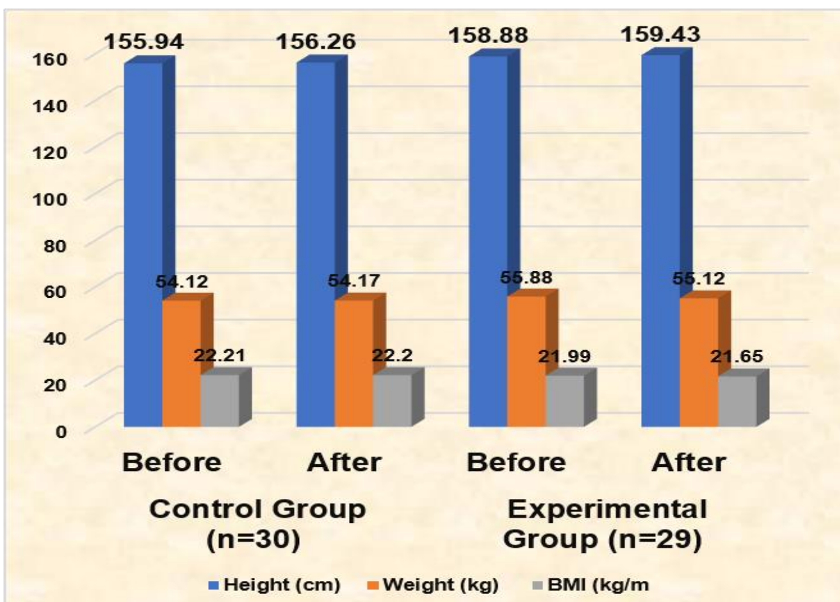


Figure 16

Impact of Supplementation of Nutribar on Anthropometric Measurements

Results on the Impact of supplementation on anthropometric measurements in the control group and experimental group after intervention revealed that the initial mean height was within the referral range of ICMR (2020) standard counterparts. There was a significant increase in the height of both the experimental and control group after the intervention. A remarkable change in height was observed among the women sprinters. Weight and Body Mass Index of the experimental and control group (17-20 years) was significantly higher than the referral range given by ICMR 2020. The experimental group showed significant decrease in weight and BMI after the supplementation, compared to the control group. There was no significant decrease in weight and BMI of the control group after the intervention.

After intervention the differences in weight was observed for the experimental group due to the supplementation of Nutribar and the exercise regimen that was followed by the subjects. There was a significant reduction in the BMI of the experimental group which showed a positive outcome of the dietary and activity intervention.

According WHO 2014, significant bodily changes occur during adolescence. Physical changes, like as height gain, muscle mass gain, and so on, are the most visible. hence, it is a period needing special attention in terms of nutritional needs. Xia *et al.,* in 2021 conducted a study on college student's physical fitness level during the COVID-19 pandemic and found out that the height and weight of both male and female student improved in 2020 along with the period because of their adolescent growth time .

4.5.1.2 Effect of Intervention on Body Composition Analysis

Table XXXII presents the impact of supplementation on Body Composition Analysis of the selected Sprinters.

Table XXXII Impact on Body Composition Analysis of the selected Sprinters

Parameter	Referral range	Mean ± S.D Experimental Group (n=29)			Mean ± S.D Control Group (n=30)		
		Before	After	t value	Before	After	t value
WHR	0.70-0.80	0.80±0.049	0.78±0.042	5.775*	0.81±0.03	0.80±0.03	1.134^{NS}
Fat %	18-28	30.89±9.22	29.52±9.13	5.041**	31.12±8.30	30.67±7.56	1.371^{NS}
Fat free mass(kg)	34-43	38.36±7.07	37.81±4.85	0.559^{NS}	37.46±4.06	37.50±3.86	0.054 ^{NS}
Total body water(kg)	25-31	27.58±3.81	28.5±3.56	4.744**	27.60±3.02	27.93±3.00	3.714**
Skeletal Muscle Mass (kg)	18.7-22.9	20.20±3.13	21.84±3.27	5.182**	19.74±3.13	19.83±3.13	0.657^{NS}
Fat mass(kg)	10-15.9	17.52±9.41	17.31±9.20	0.245^{NS}	16.89±9.49	16.67±9.04	1.019^{NS}
Lean body mass(kg)	32-39.5	36.36±7.07	37.81±4.85	1.455^{NS}	35.23±3.68	35.50±3.86	0.816^{NS}
BMR (kcal)	1126-1294	1202.31±150.79	1219.96±151.29	4.587**	1184.30±87.58	1193.16±90.07	1.691^{NS}

* Significant at p<0.05 level, ** Significant at p<0.001 level, NS= Not Significant

The data observed that the mean waist hip ratio of women sprinters of experimental group before supplementation was 0.80 and after supplementation it was recorded as 0.78, whereas the mean values of control group before intervention was 0.81 and after intervention it was 0.80. The statistical analysis shows the initial waist-hip ratio of the experimental group and control group was significantly higher than the reference level. After three months of supplementation, the experimental group showed significant decrease in WHR compared to the control. Whereas there was no significant decrease in WHR of control group.

Before intervention the mean fat % of experimental group was 30.89 per cent and after supplementation it was recorded as 29.52 per cent. Whereas before intervention the mean values of control group were 31.12 per cent and after intervention it was 30.67 per cent. after the supplementation the experimental group showed a significant decrease in the fat percentage compared to control group.

The average fat free mass of experimental group was 38.36 kg before the supplementation and after supplementation it was recorded as 37.81kg . Whereas the mean fat free mass of control group before intervention was 37.46 kg and after intervention it was 37.50 kg.

The average total body water of experimental group was 27.58 kg before the supplementation and after supplementation it was recorded as 28.5 kg. Before intervention the total body water of the control group was 27.60 kg, whereas the total body water of the control group after intervention was 27.93kg. After intervention the experimental group and control group showed significant increase in the total body water.

The mean skeletal muscle mass (kg) of the experimental group before supplementation was 20.20 kg and after supplementation it was recorded as 21.84 kg. Whereas before intervention skeletal muscle mass of control group was 19.74 kg and after intervention it was recorded as 19.83 kg. The experimental group showed a significant decrease in the SMM after the supplementation.

The average fat mass and lean body mass of experimental group before supplementation was 17.52 kg and 36.36kg after supplementation it was recorded as 17.31 kg and 37.81kg. while the average fat mass and lean body mass of control group before intervention was 16.89 kg and 35.23 kg, after intervention it was recorded as 16.67 kg and 35.50kg respectively. Both experimental group and control group the fat mass value had not significantly decreased. Whereas the mean BMR of women sprinters of experimental group before supplementation was 1202.31 kcal and after supplementation it was found to be 1219.96 kcal. Before intervention the control group showed mean BMR of 1184.30 kcal and after intervention it was observed as 1193.16 kcal. No significant increase in the BMR rate of the control group was observed, while there was significant increase in the BMR rate of the experimental group.

From Table XXXII it was found that above results it was that supplementation of developed Nutribar will significantly improve Anthropometric parameters of selected sprinters. Hence Hypothesis 1 is rejected. From the above table it was observed having a lower amount of body fat, the athletic performance can improve significantly. A healthy total body water percentage should be maintained operates properly and to limit the chance of developing health problems as a result. As energy is required in higher amounts for sprinters hence, an increase in muscle mass will increase the energy consumption resulting in remove extra body fat and weight loss in a healthy manner. As strength is required for sprinters to carry out rigorous sports activities, The development of strength and power is aided by increased lean body mass. Muscle size are directly related to strength to generate greater force in a given amount of time. along with it contributes to speed, quickness, and agility performance. A greater BMR rate helps to improve the quantity of calories burned while lowering body fat.

Sportspersons were found to have the least fat percentage and highest fat free mass (FFM) (9.57±2.80, 90.43±2.80). Sportspersons also require muscle strength for forceful and explosive activities and are likely to have least fat percentage and maximum FFM. Additionally, Indian sportspersons have comparable fat percentage to international standards. In the present study, body fat percentage decreased significantly (t-value = 5.04) for experimental group after the supplementation. Venkata Ramana et al., in 2004 reported results that indicated a significant (p<0.001) increase in lean body mass (LBM). Thus, the study concluded that the body composition was an important component in training-induced adaptations, and may influence various physiological parameters resulting in an enhanced maximal work performance. In the present study, the LBM of subjects did not increase significantly (p value = 1.57)

Figure 17 represents the Impact of supplementation of Nutribar on Body composition analysis

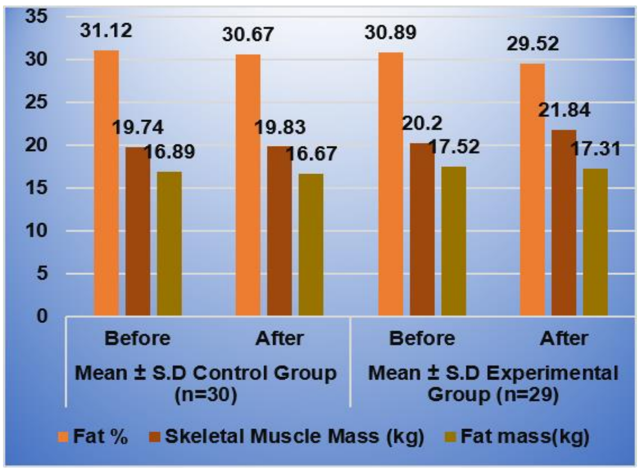


Figure 17

Impact of Supplementation on Body composition Analysis

Similar findings were reported by Gallen *et al.,*(2009) on male ultra-runners where pre-race and post-race fat mass, body mass, and skeletal muscle mass were measured with the help of anthropometric method of ultra-endurance runners in a 100km run. He reported that Total body water rose by 0.8 L (p.05), although body mass declined by 1.6 kg (p.01), fat mass by 0.4 kg (p.01), and skeletal muscle mass by 0.7 kg (p.01). Previous longitudinal studies done by Trexler *et al.,* (2017) in collegiate football players have shown an increase in exercise intensity lead to in significant increase in muscle mass and reduction of body fat by increase in the intensity of exercise.

4.5.1.3 Effect of Intervention on Biochemical parameters

Tables XXXIII presents the impact of supplementation Nutribar on biochemical parameters of selected women sprinters.

Table XXXIII Impact of supplementation of Nutribar on Biochemical Analysis of Selected Sprinters

Parameter	Mean ± S.D Experimental Group (n=29)			Mean ± S.D Control Group (n=30)		
	Before	**After**	**t value**	**Before**	**After**	**t value**
Haemoglobin(g/dl)	11.32±1.07	12.03±0.96	6.254**	11.35±1.75	11.50±1.49	1.905^{NS}
Blood Glucose (mg/dl)	79.86±9.20	89.10±8.97	5.654**	91.70±7.31	91.86±8.46	0.149^{NS}
LDH (U/L)	192.06±33.7	181.48±34.52	3.406**	198.60±30.3	177.00±29.35	6.433*

***** Significant at p<0.05 level, ** Significant at p<0.001 level, NS= Not Significant

From Table XXXIII it can be reported that majority of the sprinters had mild grade of anaemia with their mean haemoglobin levels. according to recent data of Nation Cancer Institute (NCI 2011) it is obvious that these reported levels comes under mild deficiency category of (12-15g/dl). After the intervention, a significant increase in hemoglobin was observed for both the experimental and control group. The mean hemoglobin levels of sprinters for the experimental group before supplementation showed a mild grade of anaemia with haemoglobin levels of 11.32 g/dl, while at the end of supplementation period the mean haemoglobin levels were found to be 12.03 g /dl. Whereas the mean hemoglobin levels of 11.35 g/dl the control group before intervention showed a mild degree of anaemia, while after the intervention the mean haemoglobin levels were found to be 11.50 g /dl.

Initial blood glucose levels of both the Experimental and Control group was within the referral range of 70-140 mg/dl (American Diabetic Association) .The mean blood glucose levels of experimental group sprinters before supplementation was 79.86 mg /dl , while after the supplementation the mean blood glucose levels were found to be 89.10 mg /dl which indicates that there was a significant increase in their blood glucose levels. Whereas the blood glucose levels of control group before intervention was 91.70 mg /dl, while at the end of intervention the mean blood glucose levels were found to be 91.86 mg /dl. This finding shows that there was a significant increase in the blood glucose levels of both the groups.

Lactose Dehydrogenase (LDH) of selected sprinters were within the referral 140 to 280 U/L (American Association for Clinical Chemistry) respectively. The mean serum lactose dehydrogenase levels of experimental group sprinters before supplementation was 192.06 U/L whereas after the supplementation the mean ldh were found to be 181.48 U/L which indicates that there was a significant decrease in their ldh levels. Whereas the serum lactose dehydrogenase levels of control group before intervention was 198.60 U/L, while at the end of intervention the mean serum lactose dehydrogenase levels was found to be 177.00. This finding shows that there was a significant decrease in the serum lactose dehydrogenase levels of both the groups.

The above finding showed that the majority of sprinters had improved from moderate to mild level and from mild level to normal level of hemoglobin, improved level blood glucose and decrease in LDH. The reason for the changes in the biochemical parameters may be due to the effectiveness of intervention. The increase in the hemoglobin and blood glucose content for the experimental group may be due to the presence of sweet potato, *Ulva fasciata* and basil seeds as discussed earlier in review of literature. The lower LDH activity in athletes' blood serum might be due to faster LDH breakdown in circulating blood and a more energy-saving function of muscle tissue, resulting in fewer quantities of the substrate (pyruvate) and therefore less amounts of the enzyme hydrolyzing it in a nonfunctioning muscle.

From the above results it was proved that supplementation of developed Nutribar will significantly improve Biochemical parameters of selected sprinters. Hence Hypothesis 2 is rejected

Figure 18 represents the Impact of supplementation of Nutribar on Biochemical parameters

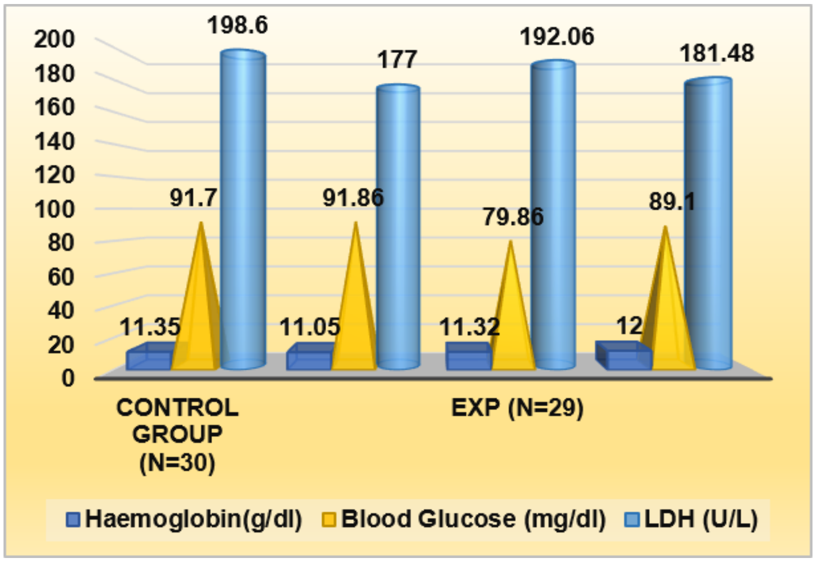


Figure 18
Impact of supplementation on Biochemical Parameters

These findings are consistent with those of Kakkar (2011), who found that mean haemoglobin before intervention was 11.2g/dl and 12.6g/dl after intervention.

Similarly, Muthulakshmi (2012) Studied the Effect of supplementation of a multi-nutrient chocolate bar on nutritional status and athletic performance. The impact showed that among swimmers, there was a significant increase in blood sugar of the experimental group., it increased significantly ($p<0.05$) to 110 mg/dl while the change was not significant in the control group.

The lowering value of Blood lactate dehydrogenase level in present research is supported by Aguilo *et al.,* (2007) that antioxidant diet supplement lower maximal blood lactate concentration supplements than in the placebo group. Parisi *et al.,* (2010) also supported the present research that the Chronic Rhodiola Rosea, a dried leaves supplementation of four weeks on fourteen trained male athletes reduced lactate levels ($P<0.05$). Bharati *et al.,* (2015) also supported that the effect of Aloe vera on cell damage in male athletes significantly reduced LDH ($P=.006$) during aerobic exercise when compared to placebo group.

4.5.1.4 Effect of Intervention on Physical Performance

Tables XXXIV presents the Impact of supplementation of Nutribar on physical performance of selected women sprinters.

Table XXXIV Impact of supplementation of Nutribar on Physical Performance in the Experimental Group and Control Group

Parameter	Scoring	Mean ± S.D Experimental Group (n=29)			Mean ± S.D Control Group (n=30)		
		Before	After	t value	Before	After	t value
30m Dash (s)	Good-4.5-5.0 Average-4.2-4.5	6.10±0.60	4.94±0.45	15.687**	6.28±0.74	4.990±0.38	8.160*
60m Dash (s)	Good-6.52	12.50±1.87	7.90±0.477	15.615**	11.19±1.27	10.31±0.32	44**
Sit-Ups	Good-37-41 Average-29-32 Fair-25-28	37.00±15.4	43.10±14.17	9.507**	36.66±16.32	37.80±16.42	3.294**
Ruler Drop Test (cm)	Excellent-<7.5,A.Ave-7.5-15.9 Average-15.9-20.4 Poor-.28cm	4.64±0.86	3.02±0.56	5.838**	10.86±3.61	9.65±2.77	4.892**
Margaria Kalamen Test (Watts)	Good-1491-1785 Average-1187-1481 Fair-902-1177	900.24±83.43	952.90±86.80	15.612**	901.58±88.40	937.22±89.72	1.198^{NS}
standing long jump (cm)	Good-156 Average146 Fair-135	140.90±19.75	156.62±11.57	8.138**	140.13±22.12	143.96±16.21	2.630*
Hexagon Agility Test	Good-12.9	16.59±2.73	12.52±0.81	9.938**	16.48±2.78	13.99±2.24	1.370^{NS}

*** Significant at p<0.05 level, ** Significant at p<0.001 level, NS= Not Significant**

From the above table, it was revealed that the mean 30m Dash score of experimental groups before supplementation was 6.10 s and after supplementation it was recorded as 4.94 s. Whereas the 30m Dash score of control group women sprinters before intervention was 6.28 s and after intervention it was recorded as 4.99 s

Mean 60m Dash scoring of experimental groups before supplementation was 12.50 s and after supplementation it was found to be 7.90 s. While the mean 60m Dash scoring of control group women sprinters before intervention was 11.19 s and after intervention it was observed as 10.31 s

Average Sit-Ups scores of experimental groups before supplementation were 36.66 and after supplementation it was recorded as 43.10. Whereas the mean score values of control group before intervention was 36.66 after intervention it was found to be 37.80

Whereas the mean Ruler Drop Test score values of experimental group supplementation was 4.64 cm and after supplementation it was recorded as 3.02 cm, whereas the mean values scores of control group before intervention was 10.86 cm after the intervention it was found as 9.65 cm after.

The mean Margaria Kalamen Test scores of experimental group before supplementation was 900.24 watts and after supplementation it was recorded as 952.90 watts, whereas the mean value scores of the control group before intervention was 901.58 watts and after intervention it was observed as 937.22 watts,

The mean standing long jump of experimental groups before supplementation was 140.90 cm and after supplementation it was found as 156.62 ,whereas the mean value scores of control group before intervention was 140.13cm and after intervention it was recorded as 143.96 cm,.

Average Hexagon Agility test score of experimental groups before supplementation was 16.59 counts and after supplementation it was recorded as

12.52 counts, whereas the mean score of control group before intervention was 16.48 counts and after intervention it was found as 13.99.

Figure 19 depicts the Impact of supplementation of Nutribar on Physical performance of sprinters.

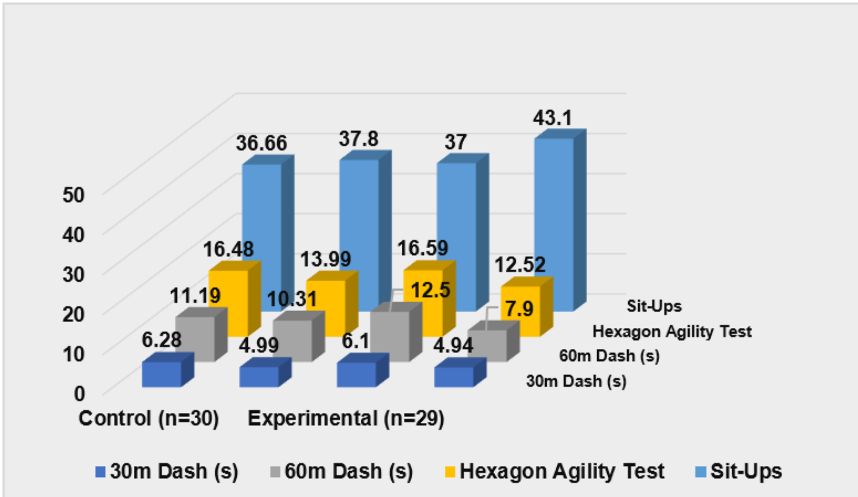


Figure 19

Impact of Supplementation on Physical Performance Of Sprinters

From the above Figure 19 it was revealed that there was a significant improvement in the performance of both the groups such as 30m dash; 60m dash; sit-ups; Ruler drop test; Margaria Kalamen test, Agility test and standing long jump after the intervention, No significant improvement was observed in the given parameters such as Margaria Kalamen test and Hexagon agility of the control group. The improvement in the physical performance among the experimental group sprinter may be due to the supplementation of energy rich developed Nutribar with the proper training. Sweet potatoes' rich fibre content delays digestion, giving the body a steady supply of fuel and energy. From the above results, it is evident that there is an improvement in the physical performance of the experimental group after supplementation of Nutribar. Hence hypothesis 3 is rejected.

Pucsok et al., in his 2021 study on the ‘Impact of COVID-19 Lockdown on Agility, Explosive Power, and Speed-Endurance Capacity in Youth Soccer Players’ found out that the participants demonstrated a significantly improved capacity of explosive strength in the lower limbs after completing the home-based exercise routine which was also observed in the present study.

Similar results have been given by DellaValle and Haas (2014) on female rowers with decreased iron stores who consumed supplementary iron during training and improved energy and endurance levels were observed in the rowers. Hence endurance athletes whose dietary patterns and physical training increase their risk of IDNA (iron depletion without anemia) were suggested for iron supplements may help you get through your endurance workout. Iron supplementation increases iron status and endurance capacity in nonanemic trained male and female volunteers who are iron deficient. (Hinton and Sinclair, 2007).

Similar results have been stated by Rowland et al. (1988) who conducted a double-blind supplementation study on 14 iron-deficient nonanemic runners with 975 mg ferrous sulphate per day. The iron-treated runners' treadmill endurance times improved dramatically during treatment as compared to controls.

4.5.2 Comparison on the changes in Anthropometric Measurements, Biochemical parameters and Physical performance between Experimental and control after the intervention

4.5.2.1 Comparison on the changes in Anthropometric Measurements between Experimental and Control after the intervention

Table XXXV and Figure 20 presents the Comparison on the changes in Anthropometric Measurements between Experimental and Control after the supplementation

Table XXXV Comparison on the changes in Anthropometric Measurements between Experimental and Control group

Description	Groups	Mean diff. ± S.D	t value
Height (cm)	Experimental	0.54±0.42	1.934^{NS}
	Control	0.31±0.46	
Weight (kg)	Experimental	0.76±1.79	1.991*
	Control	0.05±1.33	
BMI (kg/m2)	Experimental	0.33±0.88	1.730^{NS}
	Control	0.03±0.32	

* Significant at p<0.05 level, ** Significant at p<0.001 level, NS= Not Significant

. The statistical analysis revealed significant decrease in the weight of the experimental group as compared to the referral value after the supplemetation. No significant difference was observed in the parameters such as height, body mass index between the Experimental and Control groups. From the above data significant decrease was observed in the weight of experimental group after supplementation of Nutribar and intervention for three months during covid 19 pandemic when compared to control group.

The above findings were supported by Shobaki *et al* in 2018 were Eight male athletes aged 19–25 supplemented with Whey Protein Bar four months and found improved athletes post exercise body composition and other anthropometric measurements.

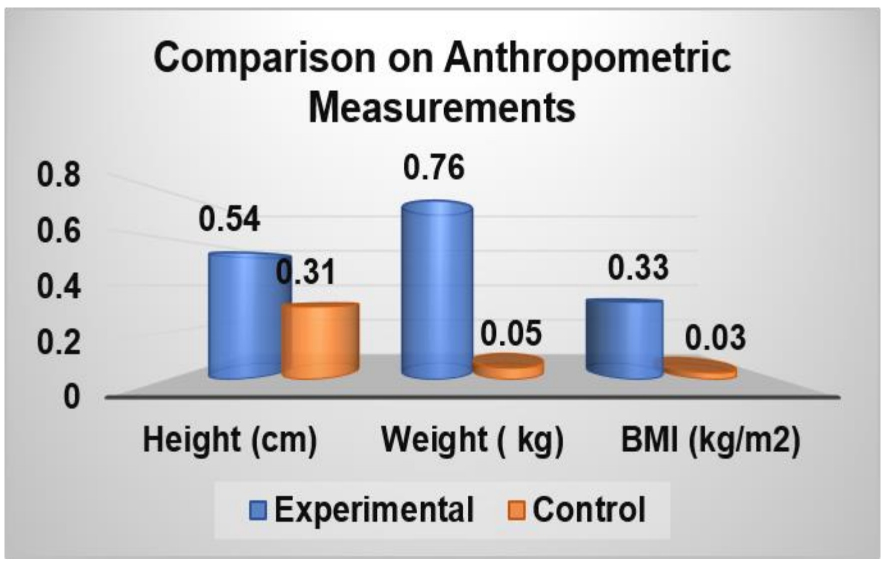


Figure 20

Comparison on The Changes In Anthropometric Measurements Between Experimental and Control

4.5.2.2 Comparison on the changes in Body composition between Experimental and Control Group after Intervention

Table XXXVI and Figure 21 presents the Comparison of changes in Body composition between Experimental and Control after the Intervention

Table XXXVI Comparison on the Changes in Body Composition Between Experimental and Control Group

Description	Groups	Mean diff. ± S.D	t value
WHR	Experimental	0.0176±0.01	3.130**
	Control	0.003±0.1	
Fat %	Experimental	1.372±1.46	2.138*
	Control	0.453±0.45	
Fat free mass(kg)	Experimental	0.55±5.34	0.496^{NS}
	Control	0.03±3.68	
Total body water(kg)	Experimental	0.92±1.04	2.777**
	Control	0.33±0.49	
Fat mass(kg)	Experimental	0.210±4.62	0.003^{NS}
	Control	0.213±1.14	
Lean body mass(kg)	Experimental	1.44±5.34	1.143^{NS}
	Control	0.26±1.78	
Skeletal Muscle Mass (kg)	Experimental	1.637±1.70	4.458**
	Control	0.093±0.77	
BMR (kcal)	Experimental	17.65±20.72	1.344^{NS}
	Control	8.86±28.72	

* Significant at p<0.05 level, ** Significant at p<0.001 level, NS= Not Significant

From table XXXVI it was observed that the comparative data on the body composition parameters showed significant decrease in the Waist hip ratio, fat %, Total body water and skeletal muscle mass of the experimental group after supplementation. Whereas no significant difference was found in Free fat mass, lean body mass, and BMR of the experimental group after supplementation of Nutribar when compared to control group.

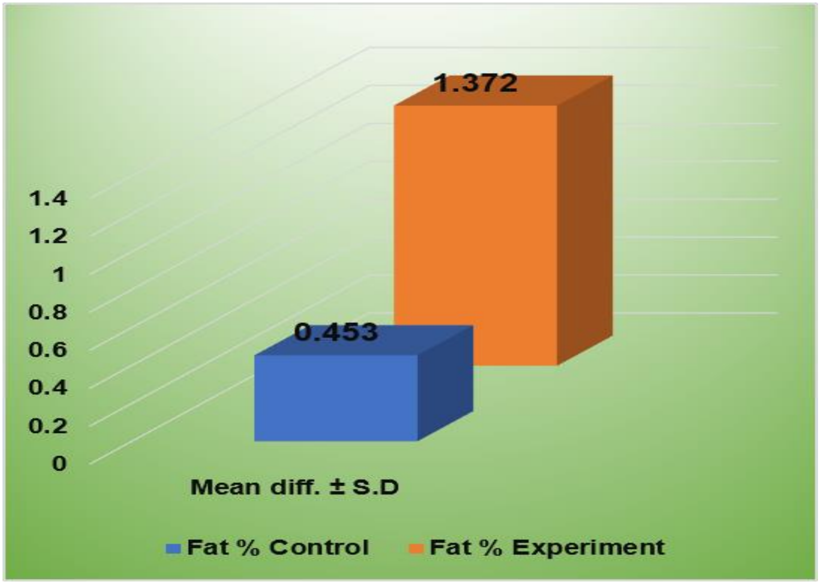


Figure 21

Comparison of changes Fat % between Experimental and Control after the supplementation

Arciero *et al.,* (2016) also demonstrated the 20–40 g of protein per meal resulted in positive changes in body composition and physical performance of the athletes.

4.5.2.3 Comparison on The Changes In Biochemical Parameters Between Experimental and Control Group After Intervention

Table XXXVII presents the Comparison of changes in biochemical Parameters between Experimental and Control after the Intervention

Table XXXVII Comparison on the Changes In Biochemical Parameters Between Experimental And Control Group

Description	Groups	Mean diff. ± S.D	t value
Haemoglobin(g/dl)	Experimental	0.6376±0.549	3.862**
	Control	0.146±0.421	
Blood Glucose((mg/dl)	Experimental	9.241±8.80	4.610**
	Control	0.166±6.12	
LDH (U/L)	Experimental	10.58±16.7	2.403*
	Control	21.600±18.38	

* Significant at p<0.05 level, ** Significant at p<0.001 level

From Table XXXVII it was observed that the comparative data on the Biochemical analysis of both Experimental and Control groups after intervention showed significant improvement in the Hemoglobin, Blood Glucose and Serum Lactose dehydrogenase of the experimental group after supplementation when compared to control group.

Comparison of Changes in Hemoglobin Level Between Experimental and Control After the Supplementation

The findings of this study are backed up by Chanu *et al.,* (2019), who investigated the effects of Hibiscus sabdariffa Linn. calyces drink on the physiical fitness and blood parameters of Thang-Ta athletes and discovered a statistically significant improvement (p0.05) between 0 and sixty and 0 and ninety days of supplementation for the thirty m flying start.

4.5.2.4 Comparison on The Changes In Physical Performance Between Experimental and Control Group After Intervention

Table XXXVIII and Figure 22 presents the Comparison of changes in Physical Performance between Experimental and Control after the Intervention

Table XXXVIII Comparison on the changes in Physical Performance between Experimental and Control Group

Description	Groups	Mean diff. ± S.D	t value
30m Dash	Experimental	1.156±0.39	7.232**
	Control	0.478±0.32	
60m Dash	Experimental	4.616±1.58	12.888**
	Control	0.900±0.00	
Sit-Ups	Experimental	6.103±3.45	7.452**
	Control	0.933±1.55	
Ruler Drop Test	Experimental	2.741±2.5	3.687**
	Control	0.916±1.02	
Margaria Kalamen Test	Experimental	52.655±18.16	15.251**
	Control	0.866±3.96	
standing long jump	Experimental	15.724±10.40	4.935**
	Control	3.833±7.98	
Hexagon Agility Test	Experimental	4.071±2.19	8.756**
	Control	0.237±0.94	

** Significant at $p<0.001$ level

From above table XXXVIII it is revealed that comparison of changes in Physical Performance between Experimental and Control Group and observed a significant improvement in 30m acceleration test, 60m dash, Sit-ups, Ruler Drop Test, Margaria Kalamen test, standing long jump and Hexagon Agility text of the experimental group after supplementation when compared to control group.

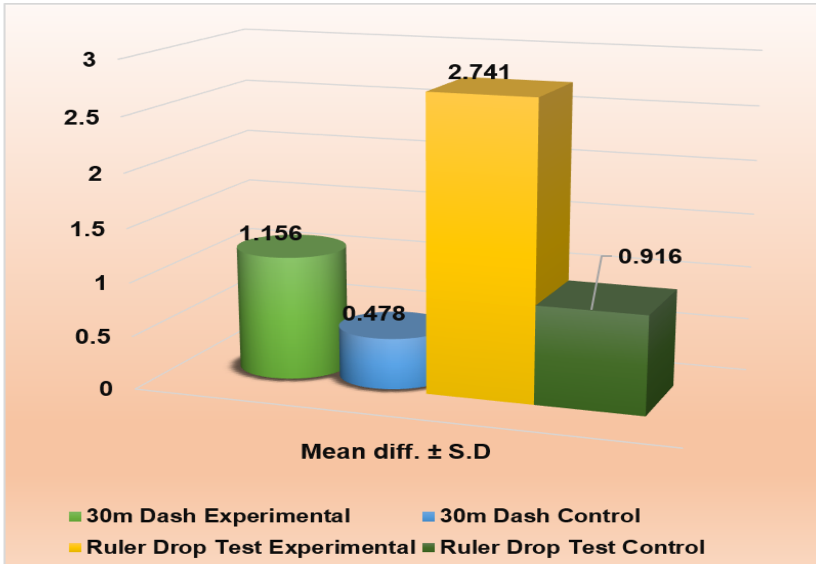


Figure 22

Comparison of changes in 30-meter test and Ruler drop test between Experimental and Control after the supplementation

Mahalakshmi et al., in 2017 studied the impact of iron supplementation on the biochemical and physical fitness component of selected sports persons for a period of 90 days. There was a significant ($p<0.05$) improvement in the '12 minute run test' after supplementation. The study concluded that supplementation of iron rich foods definitely improved the biochemical and physical fitness components of the sports persons by improving their endurance and performance. Both the above observations hold true for the present study.

Agreeing with the present study Issara et al., (2020) studied the impact of specialized physical training programs on physical fitness in athletes for 12 weeks which consisted of a speed, agility, and quickness training program. The results of this research showed that the program developed by the researcher was effective in increasing the strength of the muscles, the speed and the agility of the athletes.

4.5.2.5 Impact of Intervention on Nutrient Intake of Sprinters

Impact of intervention on Nutrient Intake of Sprinters are presented in the table XXXVIII.

Table XXXIX Impact on Nutrient Intake of the Sprinters after Intervention

Nutrients	Suggested allowance	Mean ± S.D Experimental Group (n=29)				Mean ± S.D Control Group (n=30)			
		Before	% Deficit/ Excess	After	% Deficit/ Excess	Before	% Deficit/	After	% Deficit/
Energy (kcal)	3147.6	2010.75±180.7	-36.1	2061.95±176.37	-34.5	2098.38±22.81	-33.3	2550.35±47.51	-18.95
CHO (g)	435.4	321.29±63	-26.2	342.17±59	-21.4	322.79±64.88	-25.8	367.79±64.88	-15.5
Protein (g)	131.2	43.84±10.31	-66.5	46.98±9.34	-64.1	47.51±16.89	-63.7	55.10±15.71	-58.0
Fat (g)	110.2	18.06±8.76	-83.61	20.66±7.66	-83.10	18.58±8.64	-81.13	24.85±2.95	-77.40
Fe (mg)	32	11.45±6.51	-64.2	14.20 ±6.49	-55.625	11.19 ± 3.81	-65.03	19.48±0.72	-39.12
Ca (mg)	1050	320.95±233.4	-69.4	341.75±230.2	-67.4	372.77±210.0	-64.4	411.85±206.7	-60.7
Vit A (mg)	800	201.72±374.3	-74.7	204.20±368.4	-74.4	232.80±334.2	-62.2	305.77±596.86	-61.77

The mean intake of nutrient is compared before and after intervention period for the control group and experimental group from the above table XXXIX it was found out that there was a significant increase in the energy intake of both group after intervention. The experimental group showed higher improvement than control group. The increment in the energy may be due to the supplementation of energy rich Nutribar for 3 months for the experimental groups.

The intake of fats was significantly increased in both groups after intervention period .The experimental group intake was better when compared to the control group after intervention. Adolescent eating habits are now being scrutinised as a result of globalisation and urbanisation in emerging nations.

4.5.3 Correlation between changes in the parameters of experimental group and control group after Intervention

4.5.3.1 Correlation between Nutrient Intake and Biochemical parameters of Experimental group after Supplementation of Nutribar

Table XL and Figure 23 present the Correlation between Nutrient Intake and Biochemical parameters of Experimental group after Supplementation

Table XL Correlation between Nutrient intake and Biochemical parameters for Experimental group after supplementation

After	Hemoglobin	Blood Glucose	LDH
Energy	.135	0.414*	0.012
Protein	0.255	-0.011	-0.036
CHO	0.091	0.325	0.109
Fat	0.137	0.274	0.138
Calcium	0.454*	-0.143	0.015
Iron	0.453*	-0.194	-0.168
Vit A	0.025	-0.231	0.216

*** Significant at p<0.05 level**

From the above data it is observed that there was a significant positive correlation between the energy intake and blood glucose (r = 0.414, P = 0.026). Also showed a positive correlation between Iron intake and haemoglobin (r =0.453, P =

0.014) and calcium intake and haemoglobin (r =0.454, P = 0.013) was shown after supplementing of Nutribar for 90 days. Similar findings have also been reported by Jamieson *et al.,* (2012) who reported a strong correlation between dietary iron intake and blood haemoglobin levels.

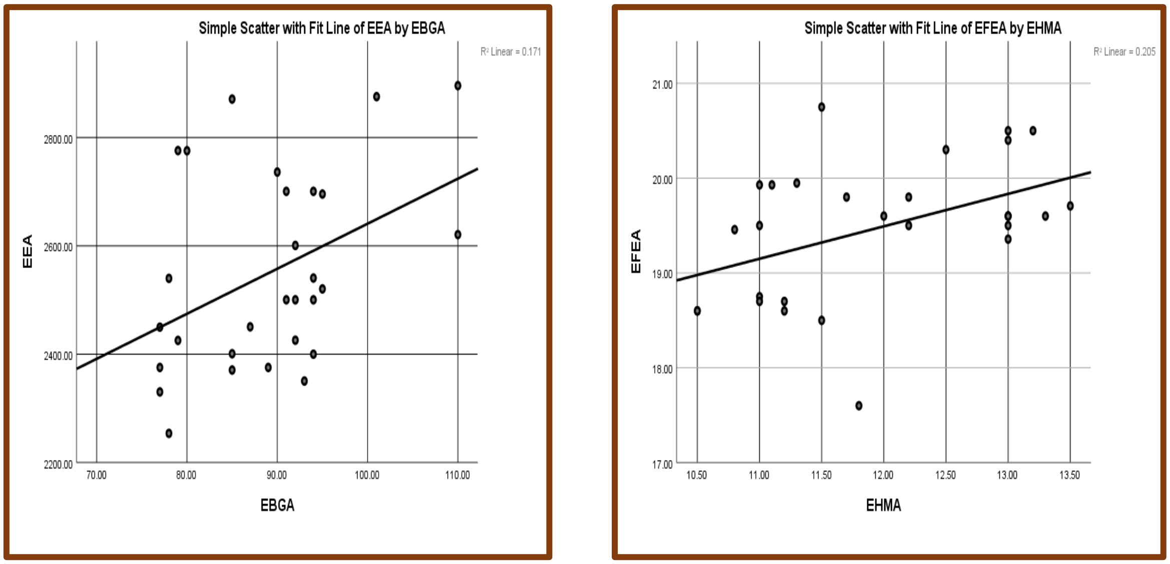


Figure 23

Positive correlation between energy intake and blood glucose; Iron intake and haemoglobin

4.5.3.2 Correlation between Nutrient Intake and Biochemical parameters of Control Group after Supplementation of Nutribar

Table XLI and Figure 24 present the Correlation between Nutrient Intake and Biochemical parameters of Control group after Supplementation

Table XLI Correlation between Biochemical Parameters and Energy Intake for Control Group after Supplementation

After	Hemoglobin	Blood Glucose	LDH
Energy	.261	0.099	0.196
Protein	0.088	0.232	0.047
CHO	0.082	0.152	-0.085
Fat	-0.014	0.536*	0.022
Calcium	-0.051	-0.287	0.106
Iron	0.219	-0.114	-0.053
Vit A	0.102	0.182	-0.054

*** Significant at p<0.05 level**

Assessment of the relationship between nutrient intake and biochemical analysis for control group after intervention by Pearson product-moment correlation coefficient revealed that there was a significant positive correlation between the fat intake and blood glucose ($r = 0.536$, $P = 0.050$).

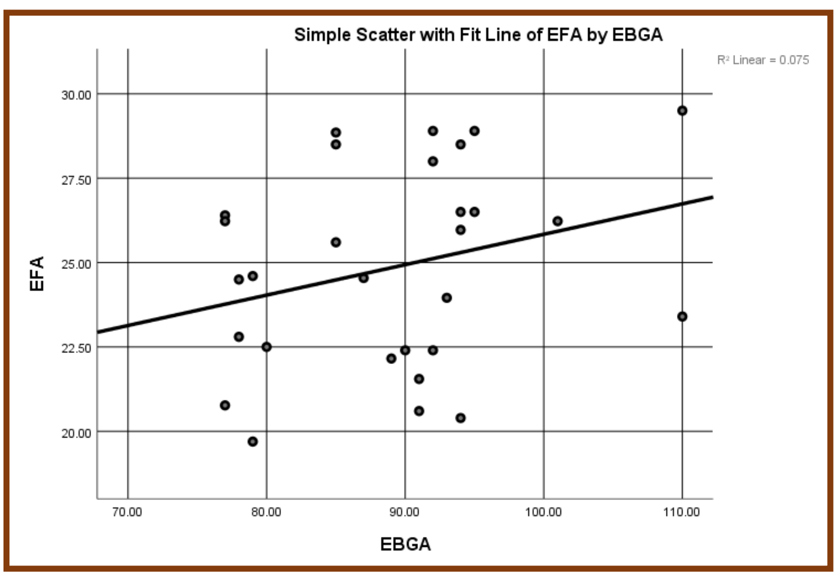


Figure 24

Positive correlation between the fat intake and blood glucose

From Table XL and XLI it was evident that there is a relationship shown between the nutrient intake and biochemical parameters of experimental group after supplementation with the Nutribar than the control group. Thus, it is evident that the consumption of developed Nutribar positively increases biochemical parameters of athletes.

4.5.3.3 Correlation between Body Composition and Physical Performance for Experimental Group after Intervention

Table XLII and Figure 25 present the Correlation between Nutrient Intake and Biochemical parameters of Control group after Intervention

Table XLII Correlation between Body Composition and Physical Performance for Experimental group after supplementation

After	30m	60 m	Sit ups	ruller	margaria	long jump	Hexagon
Pearson's R value							
Height	-.026	.012	-.098	-.180	.335	-.153	.322
Weight	.310	.272	-.265	-.270	.282	-.361*	.295
WHR	.221	.178	-.165	-.111	.080	-.402*	.053
Fat %	.504**	.469*	-.277	-.220	.133	-.436*	.453*
fat mass	.472*	.430*	-.286	-.277	.145	-.415*	.355
fat free mass	-.104	-.121	.135	-.164	.447*	-.136	.080
total body water	-.014	-.029	.135	-.274	.533*	-.071	-.089
lean body mass	-.104	-.121	-.135	-.164	.447*	-.136	.080
BMR	-.065	-.063	-.219	-.449*	.439	.139	.083
BMI	.349	.298	-.250	-.204	.273	-.366*	.197

*** Significant at p<0.05 level, ** Significant at p<0.001 level**

From Table XLI it was observed that there was a significant positive correlation between 30-m sprint time and fat percentage (r = 0.504, P = 0.005) and fat mass (r = 0.472, P = 0.010) after supplementation with Nutribar.

The findings revealed that the higher percentage of body fat will lead to slower sprint time. High fat stores causes the decrease in body's performance, so that the body's acceleration in running will decrease when the fat in the body was high. Athletes with a low percentage of body fat perform better than athletes with a high percentage of body fat.

Similar study done by Damayanti *et al.,*2015 demonstrated a significant association (p = 0.001; R=0.732) between % body fat and speed among Futsal athletes in Surabaya. This meant that the higher the percentage of body fat, the slower the sprint time.

Taghinejad (2013) evaluated the link between anthropometric measurements and physical fitness parameters among Shiraz female students and documented the inverse significant relationship between weight and BMI with speed, which is quite consistent with the findings of this study.

Figure 25 shows correlation between 30-m sprint time, Fat % and Fat mass

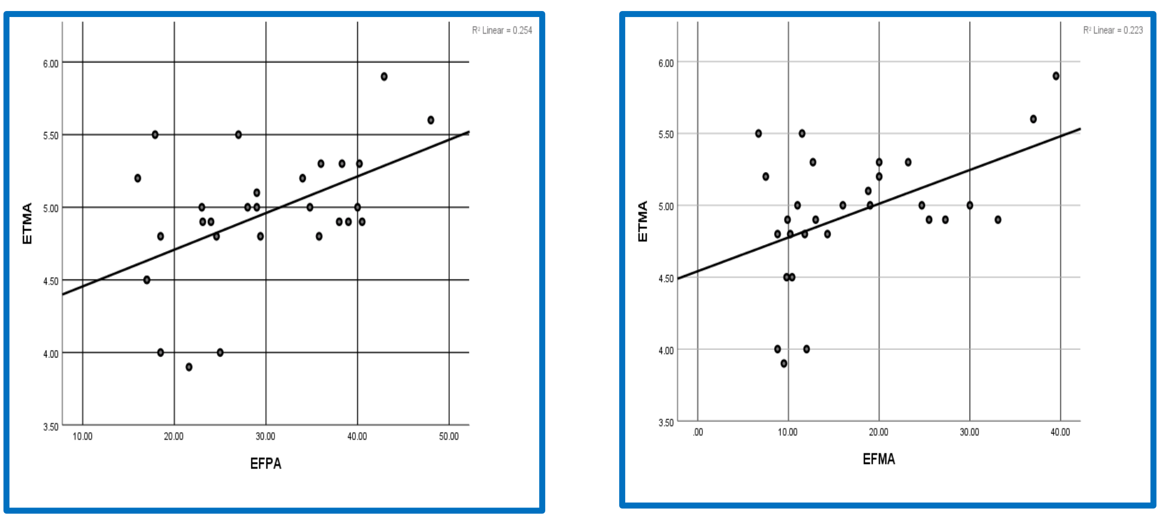


Figure 25

Positive Correlation Between 30-M Sprint Time, Fat % And Fat Mass

Results on the correlation between 60-m sprint time and body composition of the Experimental group after supplementation with Nutribar revealed that, there was a significant correlation between 60-m and fat % (r = 0.469, P = 0.010), fat mass (r = 0.430, P = 0.020). The results of this study were also supported by Anwar's (2016) study, where There was a link between football players' body fat percentage and their speed (r= 0.59; p = 0.001).

Figure 26 represents positive correlation between 60-m sprint time, Fat % and Fat mass

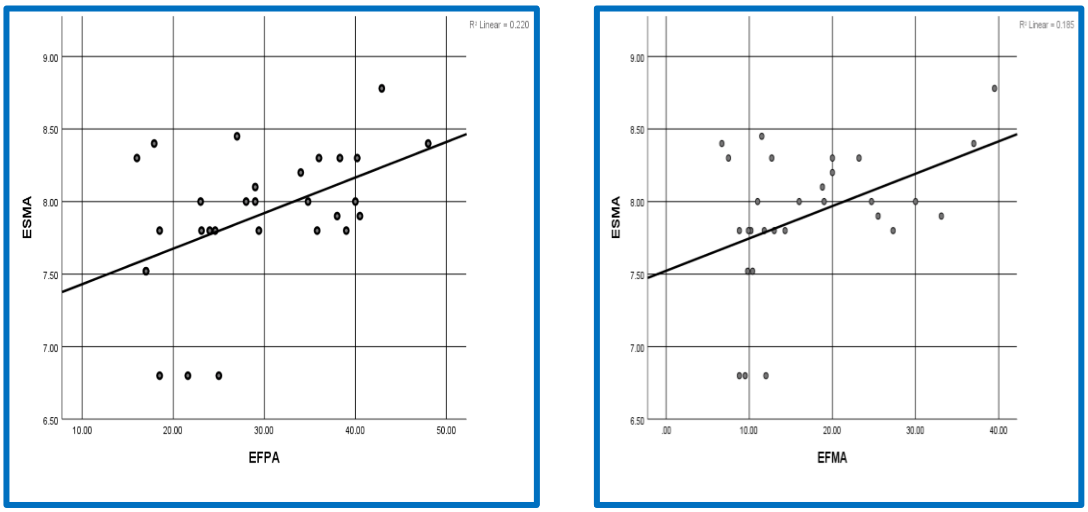


Figure 26

Positive Correlation between 60-M Sprint Time, Fat % and Fat Mass

The analysis also showed significant positive correlation observed between agility and fat percentage (r = 0.453, P = 0.014); Margaria column and fat free mass (r = 0.447, P = 0.015), Total body water (r = 0.533, P = 0.003), Lean body Mass (r = 0.447, P = 0.015), BMR (r = 0.439, P = 0.017).

The result also revealed that there was a significant negative correlation between long jump and Weight (r = -0.361, P = 0.050), WHR (r = -0.402, P = 0.030), fat % (r = -0.436, P = 0.018), fat mass (r = -0.415, P = 0.025), BMI (r = - 0.366, P = 0.051); Ruler Drop and BMR (r =- 0.449, P = 0.015).

The study is supported by Parseh *et al.,* 2015, investigated the link between body mass index and speed, agility, and balance in male students aged 15-13 years. The findings show that body mass index and speed have an inverse significant association.

Body mass index and physical fitness were examined in 513 medical students by Ziaie (2007). The study found an inverse significant link between physical fitness assessments and weight, body mass index, % body fat, and waist-hip ratio in each male and female group. This finding is in line with the findings of the current investigation.

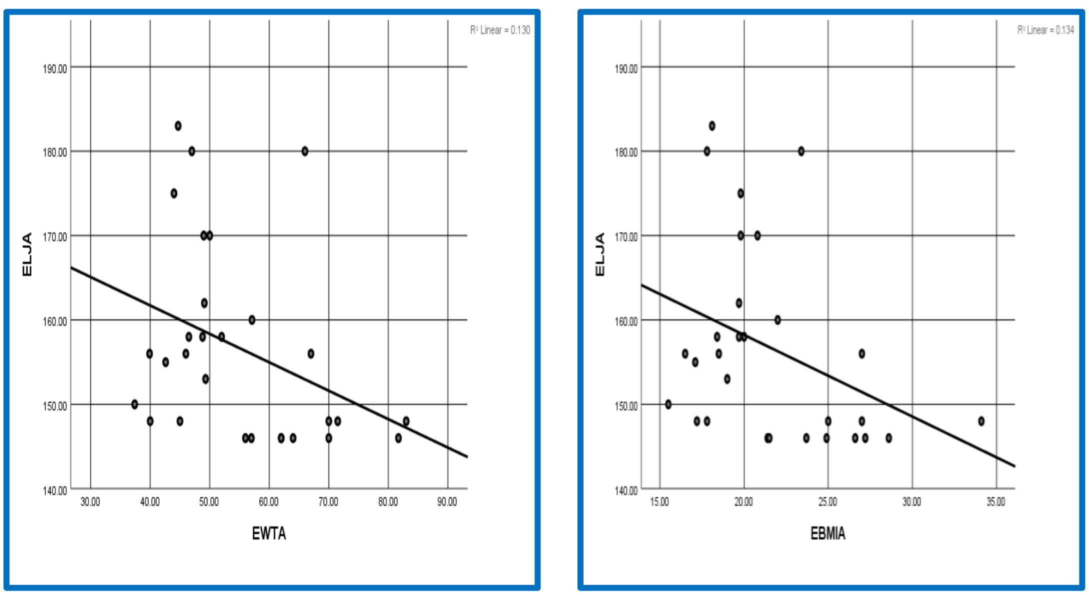


Figure 27

Positive Correlation between Margaria Column Test with Fat Free Mass & BMR

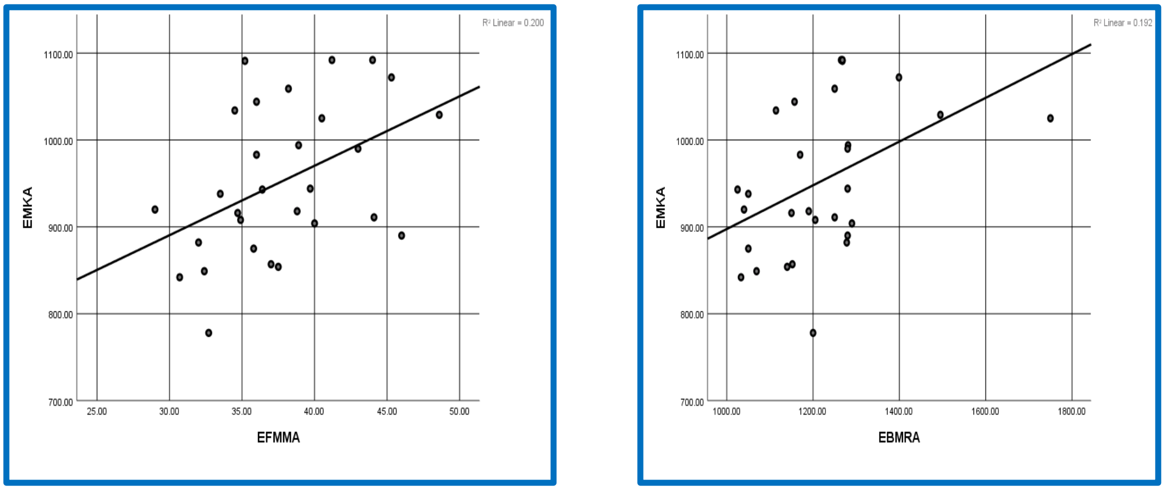


Figure 28

Negative correlation between Long jump with Weight and BMI

4.5.1.1 Correlation between Body Composition and Physical Performance for control group after Intervention

Table XLIII presents the Correlation between Body Composition and Physical Performance for control group after Intervention

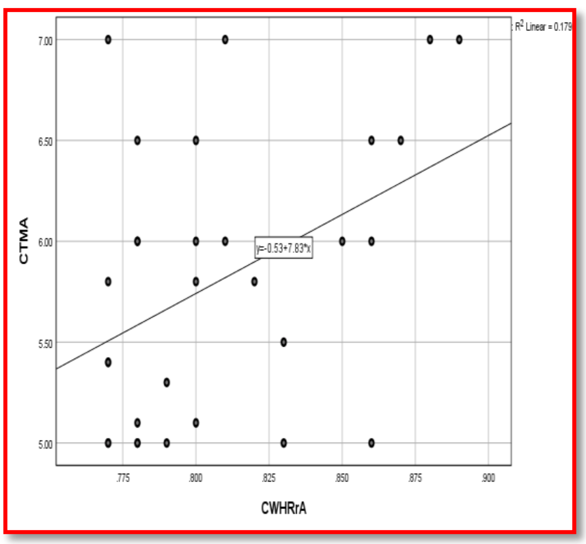
Table XLIII Correlation between Body Composition and Physical Performance for control group after Intervention

After	30m	60 m	Sit ups	ruller	margaria	long jump	Hexagon
			Pearson's R value				
Height	-.009	-.120	.076	.203	.039	.040	-.120
Weight	.354*	.362*	-.278	-.007	.365*	-.180	.038
WHR	.423*	.424*	-.362*	-.020	.279	-.187	.081
Fat %	.390*	.334	-.249	-.178	.244	-.196	.154
fat mass	.379*	.410*	-.382*	-.126	.329	-.250	.100
fat free mass	.040	-.0.12	.169	-.314	-.184	-.114	-.133
total body water	.105	-.034	.111	-.010	-.040	-.012	-.143
lean body mass	.040	-.012	.169	-.314	.184	.114	-.133
BMR	.124	-.000	.134	-.042	-.068	-.054	-.187
BMI	.364*	.398*	-.339	-.050	.292	-.202	.109

*** Significant at p<0.05 level, ** Significant at p<0.001 level**

The Pearson product-moment correlation coefficient assessed the relationship between Body Composition and Physical Performance for control group after Intervention. There was a significant positive correlation between 30-m sprint time and Weight (r = 0.354, P = 0.055), WHR (r = 423, P = 0.020), fat % (r = 0.390, P = 0.033), fat mass (r = 0.379, P = 0.039), BMI (r = 0.364, P = 0.048). Figure 29 represents correlation between 30-m sprint time, WHR and Fat % .

From the above result it is evident that there is a strong positive correlation between speed and weight of the sprinters. When the weight increases the time taking to cover 30 m test also increase. The same implies for all the above parameters. When the fat mass, Body mass index, Waist hip ration and fat % increase, it will directly affect the speed of an athlete.



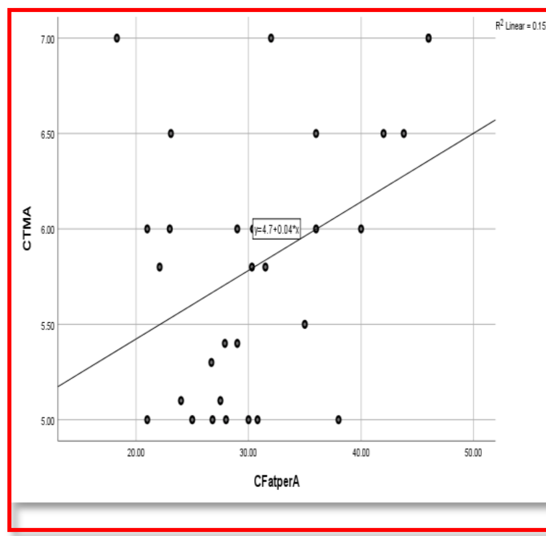


Figure 29

Positive Correlation between 30-M Sprint Time, WHR and Fat %

Results on the correlation between 60-m sprint time and body composition of for the control group after Intervention revealed that, there was a significant positive correlation between 60-m and Weight (r = 0.362, P = 0.049), WHR (r = 0.424, P = 0.020), fat mass (r = 0.410 P = 0.025), BMI (r = 0.398, P = 0.029). Figure 30 represents correlation between 60- m, weight and WHR. the running speed record is weakened with a high body mass index.

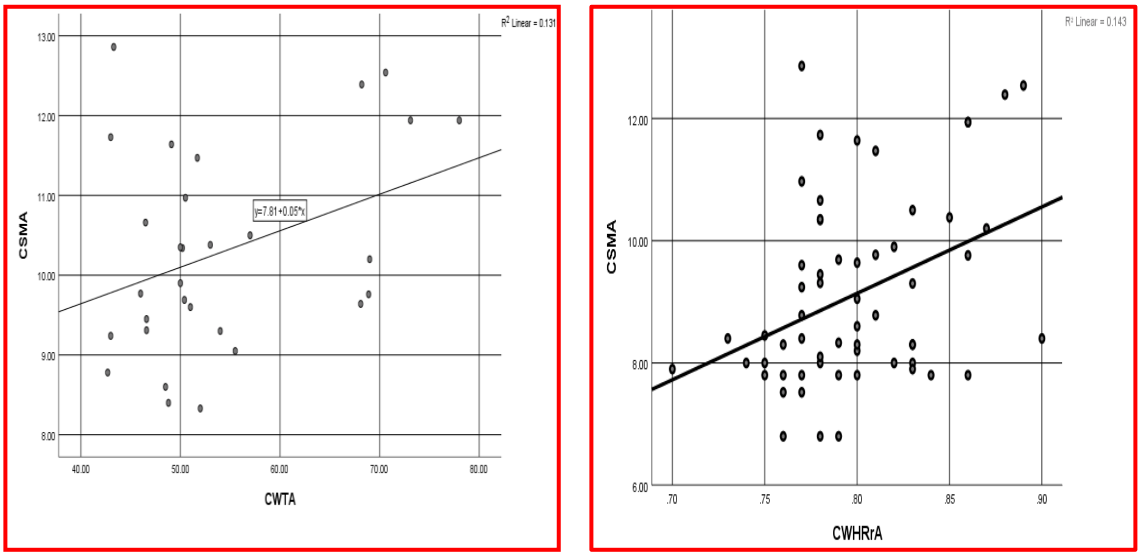


Figure 30

Positive Correlation between 60-M Sprint Time, Weight and WHR

Results also revealed there was a significant positive correlation between margaria column and weight (r = -0.362, P=0.049). There was a significant negative correlation observed between Sit-ups and WHR (r = 0.376, P=0.041) and Sit-ups and fat mass (r = -0.382, P=0.025). for the control group after Intervention. Figure 31 represents negative correlation between sit ups, WHR and fat mass.

Similarly Amirian and colleagues (2007) Top wrestlers and non-sporting persons were compared in terms of body composition and physical factors. The proportion of body fat, body weight without fat, and BMI are all factors to consider as well as physical strength, speed, and agility tests, were analysed in this study. Because there was a significant negative relationship between speed and BMI and body weight. Athletes that are lighter in weight accelerate more quickly, which is supported by study.

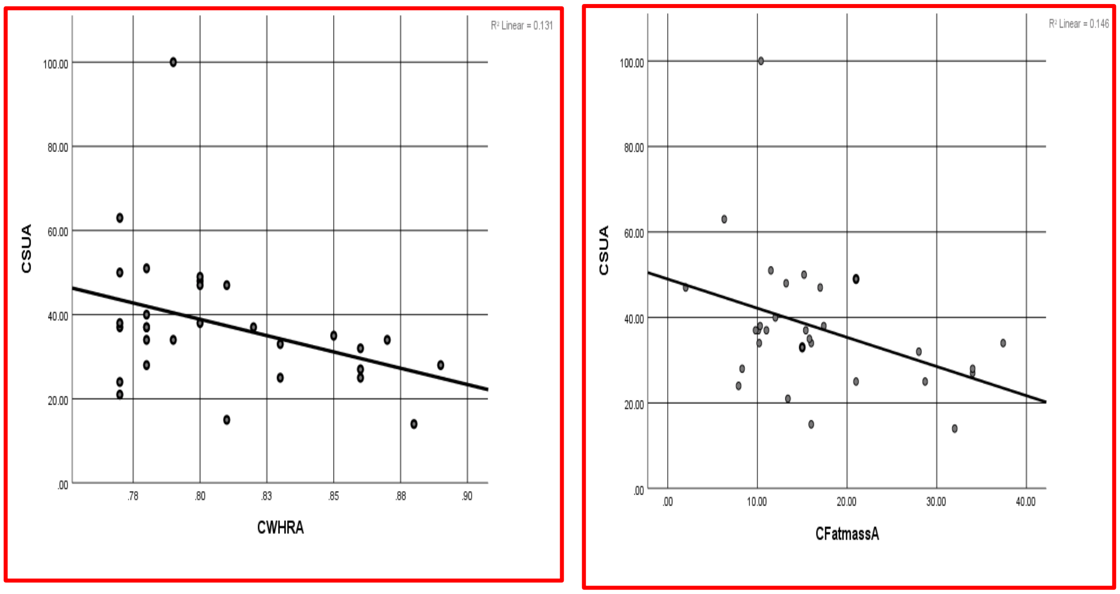


Figure 31

Negative Correlation between Sit Ups, WHR, and Fat Mass

Correspondingly, Shafizadeh (2010) investigated the association between anthropometric characteristics and individual talents among football school students. This study looked at the link between a teenager's height, weight, and BMI with their unique abilities. The results of this hypothesis revealed a substantial inverse association between weight and running ability in children aged 10 and 11.

4.5.2 Impact of Nutrition Education on Selected Sprinters

Table XLIV and Figure 32 presents the Impact of Nutrition Education on Selected Sprinters.

Table XLIV Impact of Nutrition Education on Selected Sprinters

n=59

Group	No. of Sprinters Before	Before %	No. of Sprinters After	After %
Knowledge on General Nutrition	25	42.3	52	88.1
Knowledge on Food Intake	22	37.2	56	94.91
Knowledge on Sports Nutrition and Hydration	28	47.45	58	98.30
Attitude	24	40.67	53	89.83
Practice	30	50.84	58	98.30

After nutrition education, the percentage of general nutritional knowledge from 42.3 % to 88.1 %, knowledge regarding food intake from 37.2% to 94.91 %, knowledge regarding sports nutrition from 47.45 to 98.30 % , Attitude from 40.67% ti 89.83% and practice from 50.84 to 98.30 of all the women sprinters (17 -20 years) improved. The effect of nutrition education will improve Knowledge, Attitude and Practice after the intervention. Since the Hypothesis 4 is rejected

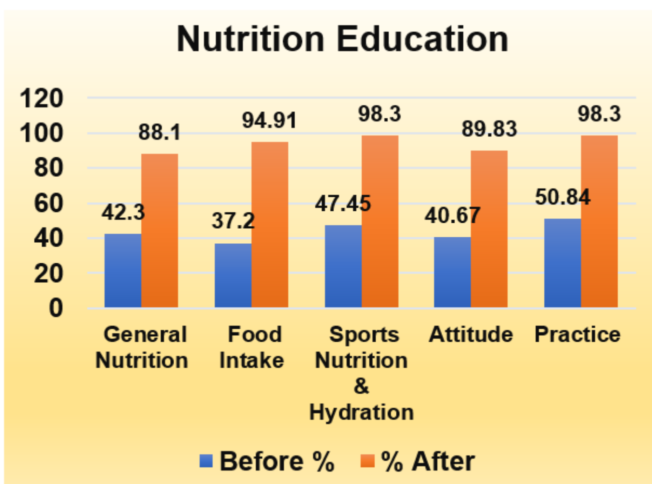


Figure 32

Impact of Nutrition Education on Selected Sprinters

From the above Figure it was observed that After receiving nutrition instruction, the sprinters' nutritional awareness improved. Colleges may be an effective and efficient means of influencing college students' health. Nutrition education and promotion programmes for rural students in secondary schools should be integrated into the educational context (Maiti *et al.,* 2011).

Palwala *et al* (2009) suggested that including nutrition education programs can be used to target the most immediate causes of under nutrition and reported significant improvements in child feeding practices of mothers after nutrition education.

Nutrition education intervention has also been shown to improve nutritional awareness and boost consumption of nutrition-rich foods in other research (Saibaba, 2002).

Hence, from the above results we can conclude that a sustainable nutrition education programme is a vital step in improving athletes' nutritional awareness of dietary habits and food choices. This plan should contain a balanced combination of palliative and preventative efforts to enhance nutritional understanding among athletes.It is evident that supplementation of the Nutraceutical energy rich Nutribar could bring about significant improvements in terms of anthropometry, clinical, biochemical and performance parameters. Similar improvements were also observed among the sprinters after imparting nutrition education. It was further observed that supplementation yielded best results followed by nutrition education in improving the performance of the sprinters. It may be concluded that supplementation Nutraceutical protentional energy rich antioxidant Nutribar along with nutrition education can be an effective strategy in improving the performance during covid 19 pandemic. Long term supplementation in post covid 19 and normal situations would throw more light on the efficiency of the nutraceutical product.