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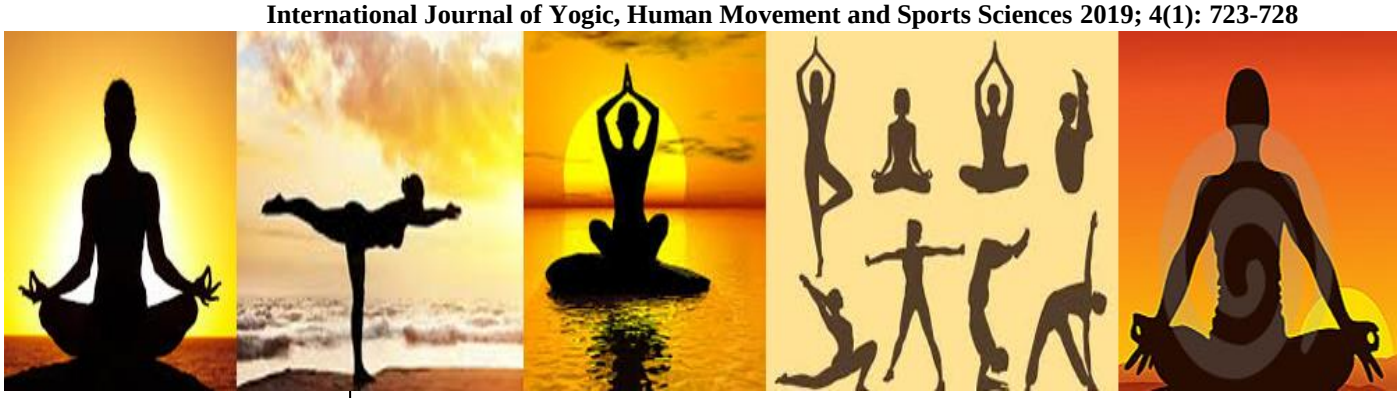

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Physical activity pattern and nutrient intake in young adults going to gymnasium in Mumbai city

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Abstract
Introduction: Physical activity and nutritional status are the two most important elements for enhancing health. Everyone performs physical activity to stay healthy, fit and improve the quality of life. Doing supervised physical activity has shown positive effects on improving health and preventing the risk of developing chronic diseases.
Objectives: To study physical activity and dietary intake of adults undergoing supervised physical activity at gymnasium
Methods: A cross-sectional survey was conducted in 98 adults (48 females) with mean age of 24.5±3.6 years. A structured questionnaire was used to collect information regarding type of physical activity and number of sets of each equipment/ machine performed. Anthropometric measurements were taken. Nutrient intake was assessed. Analyses were performed using SPSS software for Windows (version 25, 2017, IBM Corporation, Armonk, New York, United State) and other relevant statistical tests were used. $p<0.05$ was considered to be statistically significant.
Results: More than 80% of adults were involved in treadmill, cycling, bench press, cables and pulleys, leg extension, leg press, kettlebells/ dumbbells and pull down. Less than 50% participants did hack squat, stability balls and foam roller. Higher percentage of males did bench press, leg press, hack squat, peck deck, pull down and rope workout as compared to females ($p<0.05$). Females (21±8 minutes) spent significantly higher time on treadmill as compared to males (17±8 minutes) (p=0.009). There was a significant difference in the number of sets performed of bench press and cables and pulleys with higher number of sets performed by males than females ($p<0.05$). Significantly higher percentage of males [22 (44%)] consumed nutritional/ protein supplements as compared to females [8 (16.7%)] ($\chi 2=8.614$, p=0.003). 31% participants consumed >1g/kg body weight of proteins. Protein intake/ kg body weight was significantly higher in males (0.99±0.27g/kg) than females (0.84±0.16g/kg) ($p<0.05$). There was a significant positive correlation of intake of nutritional/ protein supplement with energy ($r_{pb}=0.246$), proteins ($r_{pb}=0.272$) and carbohydrates ($r_{pb}=0.221$) with group taking supplements having higher nutrient intake.
Conclusion: Dietary nutrient intake is influenced by right choice of foods included in the daily diet and the life style pattern. All adults in the study were involved in some form of muscle building exercises. Despite heavy muscle building exercises, protein intake was less than adequate in majority of adults attending gymnasium. Dietary modification such as moderate carbohydrates, low fat (good quality) and sufficient protein intake through diet are recommended. But as our Indians diets are deficient in protein intake, the use of protein supplements is suggested to avoid injuries during exercises.

Keywords: Supervised Physical Activity, Nutritional Status, Gymnasium, Anthropometric measurements, Protein supplement

Introduction
Physical activity is a very important element to enhance health. Physical inactivity can lead to risk of many chronic diseases. Physical activity is defined as any bodily movement produced by skeletal muscles that result in energy expenditure [1]. Everyone performs physical activity to enhance their health, stay fit and avoid the risk of chronic disease in later life [2]. Supervised physical activity that is going to gymnasium have good and positive effects on health. It helps the person to gain mental peace and satisfaction of workout.
Physical inactivity can lead many types of chronic diseases such as obesity, diabetes, hypertension, cholesterol, muscle weakness, bone problems, etc. which can increase the risk of mortality [3].

Studies shown that exercise intensity and duration of exercise done can help to reduce the risk of chronic diseases [4].

Obesity is one of the major cause of physical inactivity and poor dietary pattern. Obesity is defined as the accumulation of excess body fat usually ≥25% of the total body weight for men and ≥33% for women [5]. The obesity mortality risk reduces with physical active individuals regardless of the body weight [6, 7]. Hypertension is another cause of physical inactivity. The risk increases for every 10-mm Hg increase above diastolic blood pressure threshold of 80-mm Hg and every 20-mm Hg increase in the systolic blood pressure above 120-mm Hg [8, 9]. A proper low salt diet, increased physical activity levels and weight loss can help to reduce the blood pressure levels [10].

Exercises helps to reduce the health problems and enhances the quality of life. Exercise should be done to build muscle mass and loose fat mass from body. Exercises of moderate to vigorous intensity such as brisk walking, jogging, running can help to reduce the risk of chronic disease and mortality [11].

Nutritional status is another one of the important element to enhance the quality of life. It is essential to have the nutrients in order to maintain health and body shape. Studies have showed that life style changes are important in young adults because of their poor dietary behavior and lack of physical activity leading to several other health problems [12]. The sedentary life style and excessive energy intake and lack of energy expenditure leads to increase prevalence of dyslipidemia, obesity and cardiovascular diseases [13].

The individuals performing any type of moderate to vigorous physical activity need to consume more amount of protein to improve muscle mass and prevent muscle wasting. It is recommended that 1.5 -2.0 g of protein/kg body weight per day should be taken by these individuals [14]. It is even very essential to provide enough calories and low amount of fats to achieve the targeted weight. Fluid intake is also very important for physically active individuals to prevent them from dehydration and keep them hydrated all day long [15].

Methodology

A cross sectional survey was conducted where 98 samples both males and females of 18 to 30 years of age were taken, out of which 50 were males and 48 were females. The samples were taken from housing societies, families and college going students All of them signed a written consent form.

The samples who were between 18 to 30 years of age, who go to gymnasium and who were willing to participate in the study were included in this research and the samples who are having any chronic disorder, the women who are pregnant or lactating and those below 18 years of age or above 30 years of age were excluded from the study.

The basic anthropometric measurements such as height, waist circumference and hip circumferences were measured using a flexible measuring tape (measurement precision 0.1 cm) and body mass was weighed using a professional body-weight measuring machine (measurement precision 0.1 kg, SECA device). Body mass index was calculated as weight/height squared (kg/m^2), waist-to height ratio and waist-to-hip ratio was also calculated.

The subjects filled a questionnaire that comprised of Medical information, Dietary pattern, Life style pattern, Physical activity pattern, Food frequency questionnaire, three day 24-hour dietary record.

Statistical methods

Analyses were performed using SPSS software for Windows (version 25, 2017, IBM Corporation, Armonk, New York, United State). Data are presented as Mean ± SD, median (minimum-maximum) or percentage. Independent Sample T test was used to analyse the difference in anthropometry, nutrient intake and time spent on treadmill/ cycling between males and females. Mann Whitney U Test was used to analyse the difference in number of sets of physical activities performed by males and females. The frequency distributions were tabulated for various parameters according to gender and were compared using cross tabulations and chi-square test. Pearson's correlation was used to find correlation between anthropometry and nutrient intake. Point Biserial Correlation (r_{pb}) was used to find correlation between nutritional/ protein supplement intake and macro-nutrient intake. Effect size for point biserial correlation was calculated by: $r_{pb}*r_{pb}*100$.$p<0.05$ was considered to be statistically significant.

Results and Discussion

Data on 98 adults (48 females) who underwent supervised physical activity pattern with mean age of 24.5±3.6 years has been presented in the current study. The mean age of males was 24.3±3.4 years and was not significantly different from that of females (24.7±3.9 years) (p=0.544).

Anthropometric parameters

The mean height of the study participants was 165.3±8.7 cm, weight was 70.1±12 kg, BMI (body mass index) was 25.7±4.0 kg/m2, waist circumference was 79.1±10.7 cm, hip circumference was 126±94.2 cm, waist to hip ratio was 0.84±0.6 and waist to height ratio was 0.47±0.65). Table 1 gives anthropometric parameters of study population when classified according to gender. As seen in Table 1, males had significantly higher height, weight and waist to hip ratio as compared to females ($p<0.05$). On the other hand, females had significantly higher hip circumference and waist to height ratio as compared to males ($p<0.05$) (Table 1).

A study done by Keska. A *et al.* (2018) showed that doing physical activity minimizes the risk of diseases by reducing body weight and changing its composition to decrease body fat content and increase muscle mass of the body [16].

Table 1: Anthropometric measurements of participants when classified according to gender

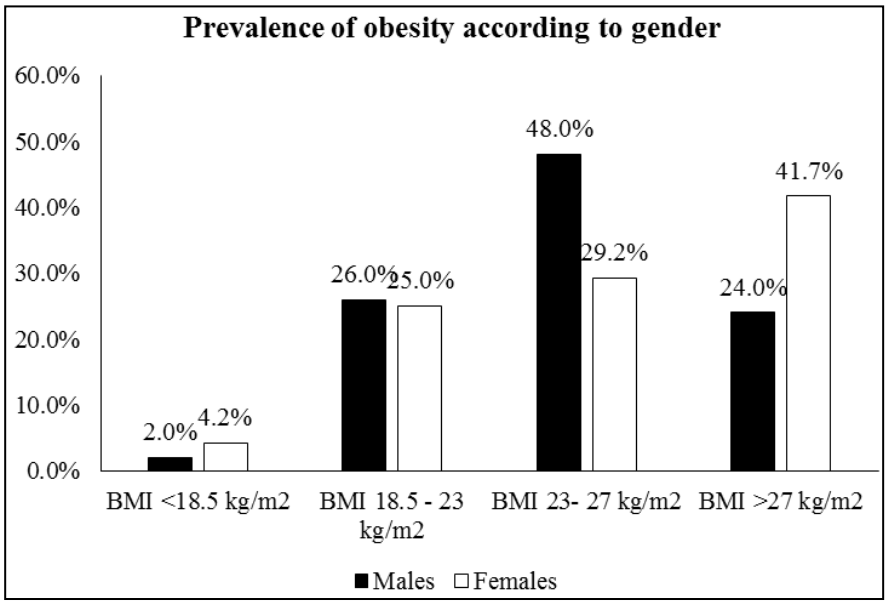
	Males (n=50)	Females (n=48)	P value
Height (cm)	170.3±8.4	160.1±5.4	0.001*
Weight (kg)	72.9±11.3	67.1±12	0.016*
BMI (kg/m^2)	25.5±3.6	26.1±4.4	0.243
Waist circumference (cm)	78.4±10.6	79.9±11	0.517
Hip circumference (cm)	90.7±11.1	97.8±13.9	0.006*
Waist to hip ratio	0.87±0.04	0.81±0.06	0.001*
Waist to height ratio	0.46±0.06	0.49±0.07	0.008*

Data presented as Mean±SD, *$p<0.05$

Prevalence of obesity according to gender

Of the 98 participants, 3 (3.1%) were underweight (BMI <18.5 kg/m^2), 25 (25.5%) were normal weight (BMI 18.5 -23 kg/m^2), 38 (38.8%) were overweight (BMI 23-27 kg/m^2) and 32 (32.7%) were obese (BMI > 27 kg/m^2). Figure 1 gives prevalence of overweight and obese participants when

classified according to gender. Higher percentage of males were overweight as compared to females (Figure 1). On the other hand, higher percentage of females were obese as compared to males (Figure 1). However, there was no significant association of BMI cut-offs with gender ($\chi2$=4.966, p=0.174) (Figure 1).



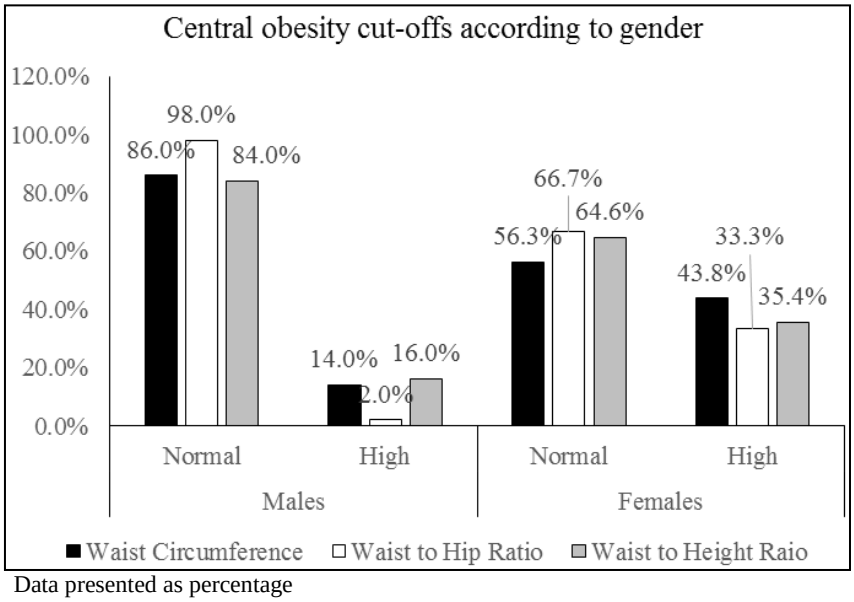
Data presented as percentage

Fig 1: Prevalence of overweight and obesity when classified according to gender

Central obesity according to gender

Of the 98 participants, 28 (28.6%) had high waist circumference, 17 (17.3%) had high waist to hip ratio and 25 (25.5%) had high waist to height ratio. Figure 2 gives percentage of participants with high waist circumference, high waist to hip ratio and high waist to height ratio when classified according gender. Significantly higher percentage of females had high waist circumference ($\chi2$=10.621), waist to hip ratio ($\chi2$=16.769) and waist to height ratio ($\chi2$=4.859) as compared to males (p<0.05).

A study by Arnaoutis. G *et al.* (2018) showed that higher general and abdominal adiposity, obese as well as adoption of low quality diet, a sedentary life style, and smoking is strongly associated with low physical fitness [17].



Data presented as percentage

Fig 2: Percentage of participants with high central obesity cut-offs when classified according to gender

Type of physical activity performed by participants

Table 2 gives percentage of participants performing various physical activity at the gymnasium. More than 80% of adults did treadmill, cycling, bench press, cables and pulleys, leg extension, leg press, kettlebells/ dumbbells and pull down (Table 2). Less than 50% participants did hack squat, stability balls and foam roller (Table 2). Table 2 gives percentage of participants performing various physical activity when classified according to gender. As seen in Table 2, higher percentage of males did bench press, leg press, hack squat, peck deck, pull down and rope workout as compared to females (p<0.05).

A study by Creasy S.A. *et al.* (2017) showed that supervised physical activity program can be more effective for increasing moderate vigorous physical activity during a weight loss intervention for adults who are overweight and obese [18].

Table 2: Type of physical activity performed by participants

	Total (n=98)	Males (n=50)	Females (n=48)	χ2 value	P value
Treadmill	86 (87.8%)	43 (86%)	43 (89.6%)	0.293	0.589
Cycling	83 (84.7%)	42 (84%)	41 (85.4%)	0.038	0.846
Bench press	86 (87.8%)	48 (96%)	38 (79.2%)	6.485	0.011*
Hammer strength	59 (60.2%)	32 (64%)	27 (56.3%)	0.614	0.433
Cables and pulleys	84 (85.7%)	45 (90%)	39 (81.3%)	1.531	0.216
Leg extension	91 (93.8%)	48 (98%)	43 (89.6%)	2.931	0.087
Abdominal bench	74 (75.5%)	40 (80%)	34 (70.8%)	1.113	0.291
Leg press	86 (87.8%)	44 (88%)	42 (87.5%)	0.006	0.940
Hack squat	40 (40.8%)	26 (52%)	14 (29.2%)	5.286	0.022*
Peck deck	65 (66.3%)	38 (76%)	27 (56.3%)	4.277	0.039*
Stability balls	31 (31.6%)	12 (24%)	19 (39.6%)	2.750	0.097
Foam roller	18 (18%)	9 (18%)	9 (18.8%)	0.009	0.924
Kettlebells/ dumbbells	92 (93.9%)	47 (94%)	45 (93.8%)	0.003	0.959
Leg adduction	67 (68.4%)	34 (68%)	33 (68.8%)	0.006	0.936
Pull down	87 (89.7%)	48 (96%)	39 (83%)	4.443	0.035*
Rope workout	56 (57.1%)	37 (74%)	19 (39.6%)	11.845	0.001*

Data presented as frequency (%), *$p<0.05$

Duration for treadmill and cycling

The mean time spent by participants on treadmill was 19±8 minutes and the mean time spent on cycle by participants was 15±6 minutes. Females (21±8 minutes) spent significantly higher time on treadmill as compared to males (17±8 minutes) (p=0.009). There was no significant difference in the amount of time spent on cycle by males (14±6 minutes) and females (16±6 minutes) (p=0.257).

Number of sets of physical activity

Table 3 gives the number of sets performed for various physical activity by the participants. As seen in Table 3, maximum sets were performed for cables and pulleys whereas least sets were performed for peck deck and leg adduction. There was a significant difference in the number of sets performed of bench press and cables and pulleys with higher number of sets performed by males than females ($p<0.05$) (Table 3). There was no significant different in the number of sets performed for other activities between males and females (p>0.05) (Table 3).

Dogan. C (2015) had done a study which showed that gym exercise is more than physical training. He observed that gym workout helped the participants to be efficient and productive, it helped them to increase control over their lives and lastly amplified with emotional resilience and mental peace [19]

Table 3: Number of sets performed for various physical activities

	Total	Males	Females	Z score	P value
Bench press	3 (1-6)	3 (1-6)	3 (2-5)	-2.505	0.012*
Hammer strength	3 (1-6)	3 (2-6)	3 (1-3)	-1.493	0.136
Cables and pulleys	3 (1-12)	3 (1-12)	3 (1-4)	-2.663	0.008*
Leg extension	3 (1-7)	3 (1-6)	3 (1-7)	-1.389	0.165
Abdominal bench	3 (1-6)	3 (2-6)	3 (1-4)	-1.204	0.229
Leg press	3 (1-6)	3 (2-6)	3 (1.4)	-1.763	0.078
Hack squat	3 (2-5)	3 (2-5)	3 (2-5)	-0.937	0.349
Peck deck	3 (1-4)	3 (2-4)	3 (1-4)	-1.698	0.090
Stability balls	3 (1-6)	2.5 (1-6)	3 (1-4)	-0.193	0.847
Foam roller	2 (1-5)	2 (1-5)	2 (1-3)	-0.327	0.744
Kettlebells/ dumbbells	3 (1-9)	3 (2-9)	3 (1-5)	-1.648	0.099
Leg adduction	3 (1-4)	3 (1-4)	3 (1-4)	-0.105	0.916
Pull down	3 (1-6)	3 (1-6)	3 (1-4)	-1.781	0.075
Rope workout	2 (1-6)	3 (1-6)	2 (1-3)	-0.981	0.3262

Data presented as Median (minimum-maximum), *$p<0.05$

Personal trainer

Overall, 35 (35.7%) participants appointed personal trainer. Even though higher percentage of females [20 (41.7%)] appointed personal trainer as compared to males [15 (30%)], this difference was not significant (χ2=1.452, p=0.228).

Use of supplements

Overall, 30 (30.6%) participants consumed nutritional/ protein supplements. Significantly higher percentage of males [22 (44%)] consumed nutritional/ protein supplements as compared to females [8 (16.7%)] (χ2=8.614, p=0.003).

Nutrient intake

The mean energy intake of the participants was 2178±244 kcal/d, protein intake was 62.4±16.0 g/d, carbohydrates intake was 259.6±33.0 g/day and fat intake was 58±8.9 g/day. Mean percentage energy from carbohydrates was 47.8±4.9%, percentage energy from proteins was 11.6±2.4%, percent energy from fats was 24.1±3.9% and protein/ body weight was 0.9±0.23g/kg. Percentage RDA intake for energy was 86.4±20.1% and percentage RDA intake for proteins was 108.3±25.3%. Table 4 gives nutrient intake of participants when classified according to gender. Males had significantly higher energy, carbohydrates, proteins, fats, percentage energy intake from proteins, percentage RDA intake and protein/ body weight from proteins as compared to females ($p<0.05$) (Table 4). Females had significantly higher percentage RDA intake from energy as compared to males

(p<0.05) (Table 4). Only 31% participants consumed >1g/kg body weight of protein.

A study by Mendonca. C.P. *et al.* (2004) showed that doing less amount of physical activity and increased consumption of fast foods, dining out, use of different modes of transport leads to unhealthy life style leading to increased risk of overweight and obesity [20].

Table 4: Nutrient intake by study participants when classified according to gender

	Males (n=50)	Females (n=48)	P value
Energy (kcal/d)	2285±257	2076±181	0.001*
Carbohydrates (g/d)	271.3±31.4	248.4±30.8	0.001*
Proteins (g/d)	70.2±18.6	55±7.8	0.001*
Fats (g/d)	59.8±9.6	56.2±7.9	0.048*
Percentage energy from carbohydrates (%)	47.8±5.4	47.9±4.3	0.932
Percentage energy from proteins (%)	12.3±2.9	10.6±1.5	0.001*
Percentage energy from fats (%)	23.9±4.9	24.4±2.7	0.547
Percentage RDA from energy (%)	78.6±25.5	94±7.6	0.001*
Percentage RDA from proteins (%)	117.3±30.7	99.6±14.3	0.001*
Protein / body weight (g/kg)	0.99±0.27	0.84±0.16	0.002*

Data presented as Mean±SD, *p<0.05

Percentage RDA intake

Overall, 10.6% participants had energy intake <75% of the RDA, 79.8% had energy intake between 75-100% of the RDA and 9.6% had energy intake >100% of the RDA. For proteins, 2.1% had protein intake <75% of the RDA, 39.4% had protein intake between 75-100% of the RDA, 46.8% had protein intake between 100-125% of the RDA and 11.7% had protein intake >125% of the RDA. Figure 3 gives percentage RDA intake by participants when classified according to gender. As seen in Figure 3, there was a significant association of percentage RDA intake of energy and gender with higher percentage of females consuming >100% of RDA of energy as compared to males (χ2=15.378, p<0.05). There was a significant association of percentage RDA intake of protein and gender with higher percentage of males consuming >125% of RDA for proteins as compared to females (χ2=10.741, p=0.013) (Figure 3).

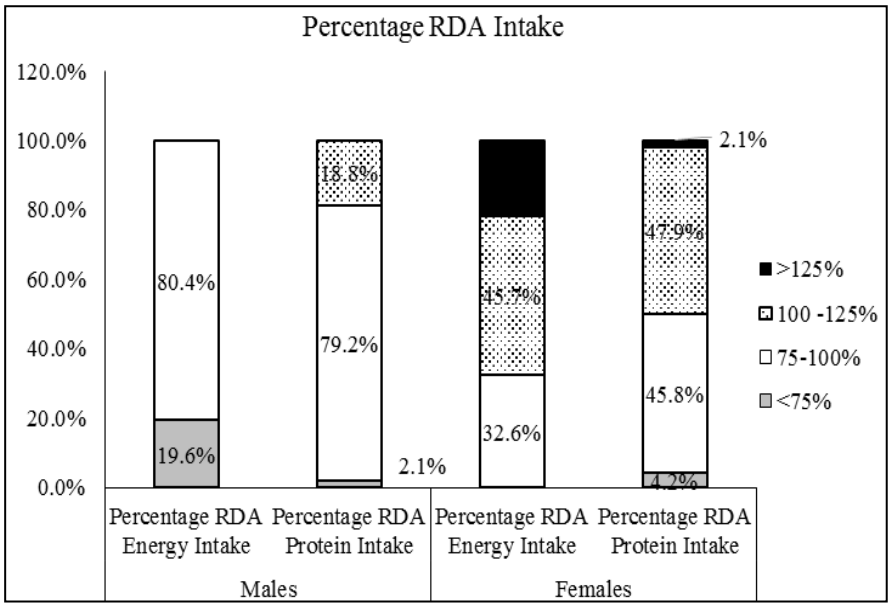


Fig 3: Percentage RDA intake of energy and protein when classified according to gender

Correlations

Weight was positively correlated with energy (r=0.330), proteins (r=0.261), carbohydrates (r=0.308) and fats (r=0.339) (p<0.05). BMI (r=0.249) and waist circumference (r=0.246) was significantly positively correlated with fat (p<0.05). Waist to hip ratio was positively correlated with energy (r=0.302), proteins (r=0.329), carbohydrates (r=0.307) and fats (r=0.339). There was a significant positive correlation of intake of nutritional/ protein supplement with energy (r_{pb}=0.246), proteins (r_{pb}=0.272) and carbohydrates (r_{pb}=0.221) with group taking supplements having higher nutrient intake. Participants who consumed supplements had 6.1% higher energy intake, 7.4% higher protein intake and 4.5% higher carbohydrate intake as compared to those who did not consume supplements.

Conclusion

Dietary nutrient intake is influenced by right choice of foods included in the daily diet and the life style pattern. All adults in the study were involved in some form of muscle building exercises. Despite heavy muscle building exercises, protein intake was less than adequate in majority of adults attending gymnasium. Dietary modification such as moderate carbohydrates, low fat (good quality) and sufficient protein intake through diet are recommended. But as our Indians diets are deficient in protein intake, the use of protein supplements is suggested to avoid injuries during exercises.

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