



Effect of Nutritional Education Program on Anthropometric Measurement of Type-2 Diabetic Patients in Raipur city

Shilpi Jain^{1*}, Jyoti Ravi Tiwari² and Abhaya R Joglekar²

¹Department of Food and Nutrition, Ravishankar Shukla University, Raipur, India

²Department of Home Science, Govt D B Girls P.G College, Raipur, India

*Corresponding author: Shilpi Jain, Department of Food and Nutrition, Ravishankar Shukla University, Raipur, India, E-mail: shilpijain100@gmail.com

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Abstract

The study was focused on effect of nutritional education program on anthropometric measurement of type-2 diabetes patients in the Raipur city, obesity is a major risk factor in the Type 2 Diabetes Mellitus patients (T2DM). The present study was aimed to compare the association between pre and post anthropometric measurements of type 2 diabetes mellitus patients. This study was done on 300 diabetic patients 192 male and 108 female patients. The functional food like; Fenugreek seed, flaxseed, centrathrum anthelmintic (kaali jeeri), nigella sativa (kalonji), almonds are very beneficial food to manage obesity of the type-2 diabetes patients. These functional foods are good source of fiber, magnesium, and other good micronutrients. The nutritional education program becomes more helpful to lose weight and manage to waist hip ratio of the patient's and assessment of Knowledge Attitudes and Practices (KAP) test of the patients. According to nutritional education program calorie, fat were reduced and protein, fiber intake of the patients were increased. In pre-test frequency the 62 patients were found obese, and after post-test frequency 51 patients found obese. The KAP test is a crucial element of diabetes mellitus control. The KAP test was became very beneficial among diabetes patients to management of obesity. So the patients reduced obesity due to nutritional education program.

Keywords: Knowledge Attitudes Practices (KAP); Diabetes Mellitus (DM).

Introduction

Type-2 Diabetes Mellitus (DM) is a chronic metabolic disorder associated with high morbidity and mortality among patients¹, 2. Obesity, which increases the risk of coronary heart disease, stroke and type 2 Diabetes Mellitus (DM), is an important determinant of health [1,2]. Obesity is a chronic metabolic disease affecting adults and children worldwide. It has become one of the leading causes of death, as obesity is known to be the main risk factor for a number of non-communicable diseases, in particular type 2 diabetes. This close

relationship led to the connotation 'disability', highlighting the fact that the majority of individuals with diabetes are overweight or obese.

A cross sectional study on Type 2 diabetes patients seeking treatment in the primary health care outpatient clinic of the University Malaya Medical Centre, Kuala Lumpur was undertaken. Two hundred and thirty-three subjects participated. They were asked questions on bio data and dietary intake using face-to-face interview techniques. Dietary intake was assessed using the 24-hour dietary recall. Anthropometric measurements including weight and height were taken and Body Mass Index (BMI) was computed to establish the extent of obesity. Of the 196 subjects, 66.8% were overweight (BMI ≥ 25 kg/m²) with 15.8% obese (BMI ≥ 30 kg/m²). The mean BMI of males and females were 25.9 ± 4.3 kg/m² and 27.2 ± 4.7 kg/m² respectively. The findings from the dietary survey showed that the mean energy intake of the subjects only achieved about 72% of the Recommended Daily Allowance (RDA) for Malaysia while protein intake of all subjects was adequate. The macronutrient contribution to the total calorie was consistent with the recommendation of the Malaysian diabetic association for a healthy diet for diabetes patients [5].

Objectives

- To determine anthropometric profile like; weight, height, waist hip ratio of the type-2 diabetic patients.
- To evaluate the pre-post anthropometric measurement of the type-2 diabetic patients after given nutrition education to the patients.

Materials and Methods

This prospective study was conducted on 25-60 years age group 192 male and 108 female patients. The study design was taken survey and informal experimental design. The 300 sample size was taken. The 150 data were collected from Paridhi diabetes research centre clinic, 100 data taken from Dr. Bandhupadhyay Clinic, 35 data taken from the Non-Communicable Disease (NCD) Clinic, and 15 patients taken from Madhumeet Diabetes Hospital, Raipur. The 300 patients were tested their Knowledge Attitudes Practices (KAP) test to enhance their knowledge in this educational program. For anthropometric measurement of height stadia meter was used. Simple bathroom scale that was recalibrated was used for weight measurement. Simple inch tape was used for weight measuring waist and hip circumference. The purpose of dietary survey was to measure the nutrients, foods and eating habitats of the type 2 diabetes patients. Dietary survey was done by using Food Frequency Questionnaire (FFQ) methods of the type 2 diabetes patients. To determine the effect of education module KAP test was conducted. Assessment of knowledge, attitudes, and practices of patients was assessment by Knowledge Attitudes and Practices (KAP) by standard questionnaire methods. A functional food booklet contains importance of nutrition, low GI (Glycemic Index) food and a healthy food practice was developed by dietitian. Importance of functional foods and herbs were suggested through these booklets. The effect of KAP test on type-2 diabetic patients, lifestyles, and daily routine etc. were analyzed in the research work. The obtained data was analyzed and the differences in the mean of various parameters were compared. The results were statistically calculated by mean, percentage, test using SPSS software version 21 [6].

Results and Discussion

| Variables | N | Pre-test (a) | | Pre-test (b) | | Mean difference (b-a) | t' |
|-------------|-----|--------------|-------|--------------|-------|-----------------------|---------|
| | | Mean | S.D. | Mean | S.D. | | |
| Weight (Kg) | 300 | 75.07 | 11.55 | 73.82 | 11.09 | - 1.25 | 12.47** |

Table 1: Comparison of pre post mean scores on anthropometric measures of type-2 diabetic patients

As shown in table 1, the weight of Type-2 diabetic patients saw a decrease when measured after nutrition education program. The pre-test mean weight was 75.07 kg while the post-test mean weight was 73.82 kg. Hence a significant decrease of 1.25 kg weight was observed among Type-2 diabetic patients in post-test measures as compared to pre-test measures.

| BMI categories | Pre-test | | Post-test | |
|--|-----------|-------|-----------|-------|
| | Frequency | % | Frequency | % |
| Underweight (<18.5 kg/m ²) | 03 | 1.0 | 04 | 1.3 |
| Normal weight (18.5-24.9 kg/m ²) | 83 | 27.7 | 95 | 31.7 |
| Over weight (25.0-29.9 kg/m ²) | 152 | 50.7 | 150 | 50.0 |
| Obesity class 1 (30-34.9 kg/m ²) | 52 | 17.3 | 44 | 14.7 |
| Obesity class 2 (35-39.9 kg/m ²) | 06 | 2.0 | 05 | 1.7 |
| Obesity class 3 (>40 kg/m ²) | 04 | 1.3 | 02 | 0.6 |
| Total | 300 | 100.0 | 300 | 100.0 |

Table 2: Pre-posttest frequency distribution of selected type-2 diabetic patients according to their BMI status

The distribution of subjects according to BMI categories as shown in table 2 indicate an increase in the distribution of subjects in the normal weight category from 27.7% in the pre-test to 31.7% in post-test measures. Similarly the percentage of subjects in "obesity class i", "obesity class ii" and "obesity class iii" saw a decrease in percentage in post-test to 14.7%, 1.7% and 0.6% from pre-test percentage of 17.3%, 2% and 1.3% respectively. A slight increase in percentage in post-test was observed in an underweight category from pre-test data.

| Waist/Hip ratio | Pre-test | | Post-test | |
|---------------------|-----------|-------|-----------|-------|
| | Frequency | % | Frequency | % |
| Excellent (<0.85) | - | - | 03 | 1.0 |
| Good (0.85-0.89) | 102 | 34.0 | 207 | 69.0 |
| Average (0.90-0.95) | 188 | 62.7 | 87 | 29.0 |
| At risk (>0.95) | 10 | 3.3 | 03 | 1.0 |
| Total | 300 | 100.0 | 300 | 100.0 |

Table 3: Pre-posttest frequency distribution of selected type-2 diabetic patients according to their waist/hip ratio status

The waist-hip ratio is a good indicator of the overall health of an individual based on fat distribution. The percentages shown in table 3 indicate a whopping jump from 34% in the pre-test to 69% in post-test to a classification "good" in waist-hip ratio. So naturally, the percentage of type-2 diabetic patients is decreased in other categories of waist-hip ratio namely "average" and "at risk". Hence the frequency distribution states the utility of managing fat percentage in type-2 diabetic patients through nutrition education and counselling.

| Variables | N | Pre-test (a) | | Pre-test (b) | | Mean difference (b-a) | t' |
|-------------|-----|--------------|-------|--------------|-------|-----------------------|---------|
| | | Mean | S.D. | Mean | S.D. | | |
| Weight (Kg) | 192 | 79.60 | 10.58 | 78.18 | 10.17 | -1.42 | 11.22** |

Table 4: Comparison of pre post mean scores on weight measures of type-2 male diabetic patients

Pre-post weight measures for type-2 male diabetic patients given in table 4 revealed a significant impact of nutrition education on weight management. A decrease of 1.42 kg was observed in pre-post-test weight of male type-2 diabetic patients with t=11.22 give it an empirical weightage at 0.01 levels.

| Age group | N | Weight | | | | Mean difference | 't' |
|-----------|----|----------|-------|----------|-------|-----------------|-------|
| | | Pre-test | | Pre-test | | | |
| | | Mean | S.D | Mean | S.D | | |
| 25-40 yrs | 82 | 80.64 | 10.34 | 79.36 | 9.87 | 1.28 | 5.74* |
| 41-55 yrs | 69 | 79.72 | 11.16 | 78.10 | 10.62 | 1.62 | 8.84* |
| 56-70 yrs | 41 | 77.34 | 9.94 | 75.97 | 9.84 | 1.36 | 5.66* |

Table 5: Comparison of pre post mean weight of type-2 male diabetic patients with reference to age group

t(df=81) at 0.05 =1.99 , t(df=81) at 0.01=2.64

t(df=68) at 0.05 =2.00 , t(df=68) at 0.01=2.65

t(df=40) at 0.05 =2.02, t(df=40) at 0.01=2.71

Pre-post weight measures for type-2 male diabetic patients given in table 5 revealed a significant impact of nutrition education in three age groups.

A mean decrease of 1.28 kg in weight was observed in male type-2 diabetic patients of 25-40 years age group; mean decrease of 1.62 kg in weight was observed in male type-2 diabetic patients of 41-55 years and a mean decrease of 1.36 kg in weight was observed in male type-2 diabetic patients of 56-70 years [7-11].

The calculated t=5.74, t=8.84 and t=5.66 revealed that nutrition education program was effective in managing the weight of male type-2 diabetic patients from all the three age groups.

| BMI categories (Male Patients) | Pre-test | | Post-test | |
|--|-----------|-------|-----------|-------|
| | Frequency | % | Frequency | % |
| Underweight (<18.5 kg/m ²) | 02 | 1.0 | 02 | 1.0 |
| Normal weight (18.5-24.9 kg/m ²) | 38 | 19.8 | 43 | 22.4 |
| Over weight (25.0-29.9 kg/m ²) | 100 | 52.1 | 106 | 55.2 |
| Obesity Class 1 (30-34.9 kg/m ²) | 45 | 23.4 | 36 | 18.8 |
| Obesity Class 2 (35-39.9 kg/m ²) | 03 | 1.6 | 03 | 1.6 |
| Obesity Class 3 (>40 kg/m ²) | 04 | 2.1 | 02 | 1.0 |
| Total | 192 | 100.0 | 192 | 100.0 |

Table 6: Pre-posttest frequency distribution of selected type-2 male diabetic patients according to their BMI status

The distribution of type-2 male diabetic patients according to BMI categories as shown in table 6 indicate an increase in the distribution of subjects in normal weight category from 19.8% in the pre-test to 22.4% in post-test measures. Similarly the percentage of subjects in "obesity class i" and "obesity class iii" saw a decrease in percentage in post-test to 18.8% and 1% from pre-test percentage of 23.4% and 2.1% while frequency distribution for underweight and obesity class 2 remain unchanged in pre-post-test measures.

| BMI categories (Male patients) | Age group | Pre-test | | Post-test | |
|--------------------------------|-----------|-----------|---|-----------|---|
| | | Frequency | % | Frequency | % |

| | | | | | |
|--|-----------|----|------|----|------|
| Underweight (<18.5 kg/m ²) | 25-40 yrs | 01 | 1.2 | 01 | 1.2 |
| | 41-55 yrs | - | - | - | - |
| | 56-70 yrs | 01 | 2.4 | 01 | 2.4 |
| Normal weight (18.5-24.9 kg/m ²) | 25-40 yrs | 12 | 14.6 | 13 | 15.9 |
| | 41-55 yrs | 15 | 21.7 | 16 | 23.2 |
| | 56-70 yrs | 11 | 26.8 | 14 | 34.1 |
| Over weight (25.0-29.9 kg/m ²) | 25-40 yrs | 49 | 59.8 | 53 | 64.6 |
| | 41-55 yrs | 31 | 44.9 | 36 | 52.2 |
| | 56-70 yrs | 20 | 48.8 | 17 | 41.5 |
| Obesity class 1 (30-34.9 kg/m ²) | 25-40 yrs | 19 | 23.2 | 14 | 17.1 |
| | 41-55 yrs | 19 | 27.5 | 14 | 20.3 |
| | 56-70 yrs | 07 | 17.1 | 08 | 19.5 |
| Obesity class 2 (35-39.9 kg/m ²) | 25-40 yrs | - | - | - | - |
| | 41-55 yrs | 01 | 1.4 | 02 | 2.9 |
| | 56-70 yrs | 02 | 4.9 | 01 | 2.4 |
| Obesity class 3 (>40 kg/m ²) | 25-40 yrs | 01 | 1.2 | 01 | 1.2 |
| | 41-55 yrs | 03 | 4.3 | 01 | 1.4 |
| | 56-70 yrs | - | - | - | - |

Table 7: Pre-posttest frequency distribution of selected type-2 male diabetic patients with reference to BMI categories in different age groups

The distribution of type-2 male diabetic patients according to BMI categories and age group as shown in table 7 indicate that in all the age groups improvement was observed after 03 months nutritional counseling. In post-test measures, the percentage of subjects in the normal weight category was increased in each age group as compared to pre-test measures.

| Waist/Hip ratio | Pre-test | | Post-test | |
|-------------------|-----------|---|-----------|-----|
| | Frequency | % | Frequency | % |
| Excellent (<0.85) | - | - | 03 | 1.6 |

| Waist/Hip ratio | Pre-test | | Post-test | |
|---------------------|-----------|-------|-----------|-------|
| | Frequency | % | Frequency | % |
| Excellent (<0.85) | - | - | 03 | 1.6 |
| Good (0.85-0.89) | 64 | 33.3 | 122 | 63.5 |
| Average (0.90-0.95) | 122 | 63.5 | 64 | 33.3 |
| At risk (>0.95) | 06 | 3.1 | 03 | 1.6 |
| Total | 192 | 100.0 | 192 | 100.0 |

Table 8: Pre-posttest frequency distribution of selected type-2 male diabetic patients according to their waist/hip ratio status

The waist-hip ratio is a good indicator of the overall health of an individual based on fat distribution. The percentages shown in table 8 indicate a considerable jump from 33.3% in the pre-test to 63.5% in post-test to a classification "good" in waist-hip ratio. So naturally, the percentage of Type-2 diabetic patients is decreased in other categories of waist-hip ratio namely "average" and "at risk". Hence the frequency distribution states the utility of managing fat percentage in Type-2 male diabetic patients through nutritional counseling.

| BMI categories (Male patients) | Age group | Pre-test | | Post-test | |
|--------------------------------|-----------|-----------|------|-----------|------|
| | | Frequency | % | Frequency | % |
| Excellent (<0.85) | 25-40 yrs | - | - | - | - |
| | 41-55 yrs | - | - | 02 | 2.9 |
| | 56-70 yrs | - | - | 01 | 2.4 |
| Good (0.85-0.89) | 25-40 yrs | 22 | 26.8 | 54 | 65.9 |
| | 41-55 yrs | 27 | 39.1 | 40 | 58.0 |
| | 56-70 yrs | 15 | 36.6 | 28 | 68.3 |
| Average (0.90-0.95) | 25-40 yrs | 57 | 69.5 | 26 | 31.7 |
| | 41-55 yrs | 39 | 56.5 | 27 | 39.1 |
| | 56-70 yrs | 26 | 63.4 | 11 | 26.8 |
| At risk (>0.95) | 25-40 yrs | 03 | 3.7 | 02 | 2.4 |
| | 41-55 yrs | 03 | 4.3 | - | - |
| | 56-70 yrs | - | - | 01 | 2.4 |

Table 9: Pre-posttest frequency distribution of selected type-2 male diabetic patients according to their waist/hip ratio status in various age groups

The percentages shown in table 9 indicate a considerable jump from 26.8%, 39.1% and 36.6% for age groups 25-40 years, 41-55 years and

56-70 years in the pre-test to 65.9%, 58% and 68.3% in post-test to a classification "good" in waist-hip ratio. So naturally, the percentage of type-2 diabetic patients in all age groups is decreased in other categories of waist-hip ratio namely "average" and "at risk". Hence the frequency distribution states the utility of managing fat percentage in type-2 male diabetic patients through nutritional counseling in different age groups.

| Variables | N | Pre-test (a) | | Pre-test (b) | | Mean difference (b-a) | t' |
|-------------|-----|--------------|------|--------------|------|-----------------------|-------|
| | | Mean | S.D | Mean | S.D | | |
| Weight (Kg) | 108 | 67.00 | 8.40 | 66.05 | 8.02 | - 0.95 | 5.90* |

Table 10: Comparison of pre post mean scores on weight measures of type-2 female diabetic patients

t(df=107) at 0.05=1.98, t(df=107) at 0.01=2.63

Pre-post weight measures for type-2 female diabetic patients given in table 10 revealed a significant impact of nutrition education on weight management. A decrease of 0.95 kg was observed in pre-post weight of female type-2 diabetic patients with t=5.90 give it an empirical weightage at 0.01 levels.

| Age group | N | Weight | | | | Mean difference (b-a) | t' |
|-------------|----|--------------|-------|--------------|------|-----------------------|-------|
| | | Pre-test (a) | | Pre-test (b) | | | |
| | | Mean | S.D | Mean | S.D | | |
| 25-40 years | 33 | 66.76 | 4.94 | 66.36 | 5.34 | -0.40 | 1.92 |
| 41-55 years | 40 | 68.20 | 10.26 | 66.80 | 9.96 | -1.40 | 4.93* |
| 56-70 years | 35 | 65.87 | 8.67 | 64.91 | 7.72 | -0.96 | 3.13* |

Table 11: Comparison of pre post mean weight of type-2 female diabetic patients with reference to age group

t(df=32) at 0.05=2.03, t(df=32) at 0.01=2.72

t(df=39) at 0.05=2.02, t(df=39) at 0.01=2.71

t(df=34) at 0.05=2.03, t(df=34) at 0.01=2.72

Pre-post weight measures for type-2 female diabetic patients given in table 11 revealed a significant impact of nutrition education in age groups 41-55 years and 56-70 years and a non-significant decrease in the age group 25-40 years. A mean decrease of 0.40 kg in weight was observed in female type-2 diabetic patients of 25-40 years age group; mean decrease of 1.40 kg in weight was observed in female type-2 diabetic patients of 41-55 years and a mean decrease of 0.96 in weight was observed in female type-2 diabetic patients of 56-70 years. The calculated t=1.92, t=4.93 and t=3.13 revealed that nutrition education

program was effective in managing the weight of female type-2 diabetic patients from all the three age groups.

| BMI categories (male patients) | Pre-test | | Post-test | |
|--|-----------|-------|-----------|-------|
| | Frequency | % | Frequency | % |
| Underweight (<18.5 kg/m ²) | 01 | 0.9 | 02 | 1.9 |
| Normal weight (18.5-24.9 kg/m ²) | 45 | 41.7 | 52 | 48.1 |
| Over weight (25.0-29.9 kg/m ²) | 52 | 48.1 | 44 | 40.7 |
| Obesity class 1 (30-34.9 kg/m ²) | 07 | 6.5 | 08 | 7.4 |
| Obesity class 2 (35-39.9 kg/m ²) | 03 | 2.8 | 02 | 1.9 |
| Obesity class 3 (>40 kg/m ²) | - | - | - | - |
| Total | 108 | 100.0 | 108 | 100.0 |

Table 12: Pre-posttest frequency distribution of selected type-2 female diabetic patients according to their BMI status

The distribution of type-2 female diabetic patients according to BMI categories as shown in table 12 indicate an increase in the distribution of subjects in normal weight category from 41.7% in the pre-test to 48.1% in post-test measures. Similarly, the percentage of subjects in the overweight category was decreased in post-test measures.

| BMI categories (Female patients) | Age group | Pre-test (N=108) | | Post-test (N=108) | |
|--|-----------|------------------|------|-------------------|------|
| | | Frequency | % | Frequency | % |
| Underweight (<18.5 kg/m ²) | 25-40 yrs | - | - | - | - |
| | 41-55 yrs | - | - | - | - |
| | 56-70 yrs | 01 | 2.9 | 02 | 5.7 |
| Normal weight (18.5-24.9 kg/m ²) | 25-40 yrs | 11 | 33.3 | 13 | 39.4 |
| | 41-55 yrs | 19 | 47.5 | 23 | 57.5 |
| | 56-70 yrs | 15 | 42.9 | 16 | 45.7 |

| | | | | | |
|--|-----------|----|------|----|------|
| Over weight (25.0-29.9 kg/m ²) | 25-40 yrs | 21 | 63.6 | 19 | 57.6 |
| | 41-55 yrs | 15 | 37.5 | 11 | 27.5 |
| | 56-70 yrs | 16 | 45.7 | 14 | 40.0 |
| Obesity Class 1 (30-34.9 kg/m ²) | 25-40 yrs | 01 | 3.0 | 01 | 3.0 |
| | 41-55 yrs | 04 | 10.0 | 04 | 10.0 |
| | 56-70 yrs | 02 | 5.7 | 03 | 8.6 |
| Obesity Class 2 (35-39.9 kg/m ²) | 25-40 yrs | - | - | - | - |
| | 41-55 yrs | 02 | 5.0 | 02 | 5.0 |
| | 56-70 yrs | 01 | 2.9 | - | - |
| Obesity Class 3 (>40 kg/m ²) | 25-40 yrs | - | - | - | - |
| | 41-55 yrs | - | - | - | - |
| | 56-70 yrs | - | - | - | - |

Table 13: Pre-posttest frequency distribution of selected type-2 female diabetic patients with reference to BMI categories in different age groups

The distribution of type-2 female diabetic patients according to BMI categories and age group as shown in table 13 indicate that in all the age groups improvement was observed after 03 months nutritional counseling. In post-test measures, the percentage of subjects in the normal weight category was increased in each age group as compared to pre-test measures.

| Waist/hip ratio | Pre-test | | Post-test | |
|---------------------|-----------|-------|-----------|-------|
| | Frequency | % | Frequency | % |
| Excellent (<0.85) | - | - | - | - |
| Good (0.85-0.89) | 38 | 35.2 | 85 | 78.7 |
| Average (0.90-0.95) | 66 | 61.1 | 23 | 21.3 |
| At risk (>0.95) | 04 | 3.7 | - | - |
| Total | 108 | 100.0 | 108 | 100.0 |

Table 14: Pre-posttest frequency distribution of selected type-2 female diabetic patients according to their waist/hip ratio status

The percentages shown in table 14 indicate a considerable jump from 35.2% in pre-test to 78.7% in post-test to a classification "good" in waist-hip ratio. So naturally, the percentage of type-2 female diabetic patients is decreased in other categories of waist-hip ratio

namely "average" and "at risk". Hence the frequency distribution states the utility of managing fat percentage in type-2 female diabetic patients through nutritional counselling.

| W/H ratio (Female patients) | Age group | Pre-test | | Post-test | |
|-----------------------------|-----------|------------|------|------------|------|
| | | Frequen cy | % | Frequen cy | % |
| Excellent (<0.85) | 25-40 yrs | - | - | - | - |
| | 41-55 yrs | - | - | - | - |
| | 56-70 yrs | - | - | - | - |
| Good (0.85-0.89) | 25-40 yrs | 13 | 39.4 | 27 | 81.8 |
| | 41-55 yrs | 16 | 40.0 | 31 | 77.5 |
| | 56-70 yrs | 09 | 25.7 | 27 | 77.1 |
| Average (0.90-0.95) | 25-40 yrs | 20 | 60.6 | 06 | 18.2 |
| | 41-55 yrs | 22 | 55.0 | 09 | 22.5 |
| | 56-70 yrs | 24 | 68.6 | 08 | 22.9 |
| At risk (>0.95) | 25-40 yrs | - | - | - | - |
| | 41-55 yrs | 02 | 5.0 | - | - |
| | 56-70 yrs | 02 | 5.7 | - | - |

Table 15: Pre-posttest frequency distribution of selected type-2 female diabetic patients according to their waist/hip ratio status in various age groups

The percentages shown in table 15 indicate a considerable jump from 39.4%, 40% and 25.7% for age groups 25-40 years, 41-55 years and 56-70 years in pre-test to 81.8%, 77.5% and 77.1% in post-test to a classification "good" in waist-hip ratio. So naturally, the percentage of type-2 female diabetic patients in all age groups is decreased in other categories of waist-hip ratio namely "average" and "at risk". Hence the frequency distribution states the utility of managing fat percentage in Type-2 female diabetic patients through nutritional counseling in different age groups.

| Socio-demographic variables | | Gain score |
|-----------------------------|---|------------|
| | | Weight |
| Age | R | -0.049 |
| Gender | R | 0.129* |
| Marital status | R | 0.098 |
| Education | R | -0.111 |
| Family income | R | 0.037 |

Table 16: Relationship between socio-demographic variables with gain scores on weight.

*: Significant at 0.05 levels. A perusal of 't' shown in table 16 shows non-significant association between socio demographic variables namely age, marital status, education and family income with pre-post mean difference on weight measures. Only gender was significantly associated with weight of the selected type-2 diabetic patients which shows that weight loss is more in females than male type-2 diabetic patients.

Conclusion

The present study was to assess patients' the weight of type-2 diabetic patients saw a decrease when measured after nutrition education program. There is strong evidence that the three months of nutritional counseling had an effect on dietary intake of type-2 diabetic patients. The pre-test mean calorie, fat and carbohydrate intake was decreased in post-test measures after administration of nutrition education program while intake of protein and fiber was increased during the pre-post test period at .01 level of statistical significance. The distribution of subjects according to BMI categories showed an increase in the distribution of subjects in the normal weight category from 27.7% in the pre-test to 31.7% in post-test measures. These results are by an large consistent across gender and three age groups namely 25-40 years, 41-55 years and 56-70 years respectively. A whopping jump from 34% in the pre-test to 69% in post-test to a classification "Good" in waist-hip ratio. So naturally, the percentage of Type-2 diabetic patients is decreased in other categories of waist-hip ratio namely "average" and "at risk". Hence the frequency distribution states the utility of managing fat percentage in type-2 diabetic patients through nutrition education and counseling. There is strong evidence that the three months of nutritional counseling had an effect on weight measures of type-2 diabetic patients and pre-test mean weight was decreased in post-test measures after administration of nutrition education program at .01 level of statistical significance.

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