Original Article

Type II Diabetic Patients' Satisfaction, Medication Adherence, and Glycemic Control after the Application of Pharmacist Counseling Program

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Abstract

Background: Health complications with type 2 diabetes mellitus (T2DM) increases as the patient's age increases. This study aimed to investigate if the pharmacist counseling program has an impact on patient medication adherence and satisfaction of elderly diabetic patients. Moreover, it was aimed to investigate the impact of patients' adherence to HbA1c. **Methods:** This is a comparative study that was carried out in the diabetic clinic in a governmental hospital at King Saud Hospital, Unaizah city, in Saudi Arabia, over a period of eight months starting from June 2015. 102 patients were included in this study. In order to evaluate adherence and satisfaction, we used Morisky Medication Adherence Scale-8 (MMAS-8) and Diabetes Medication Satisfaction (DiabMedSat) questionnaires, respectively. **Results:** The mean total score of pre-MMAS-8 was 4.15±0.85. The mean total score of post-MMAS-8 was 5.67±0.51. The level of adherence after the intervention program showed 88.2% of patients with a low level of adherence and 11.8% of patients with a moderate level of adherence. The difference between the pre total satisfaction (49.13±11.01) and post total satisfaction (54.45±9.19) was significant (p=0.001). The correlation analysis between medication adherence and HbA1c in the present study revealed a non-significant correlation. **Conclusion:** The intervention program has improved medication adherence, satisfaction, and HbA1c level among elderly patients with T2DM. Gender was significantly associated with medication adherence, satisfaction, and HbA1c level. In addition, the patient's education level was significantly associated with medication adherence and satisfaction.

Keywords: Adherence; Satisfaction; HbA1c, MMAS-8, T2DM

Introduction

The growing health care needs of the aging population in Saudi Arabia require effective intervention measures to reduce impending health risks [1]. The health care providers are deemed to receive training and education in geriatrics to effectively deliver appropriate intervention programs that are designed to improve health outcomes [2]. This is because diabetes mellitus (DM) is predominant across different age groups in Saudi Arabia. A recent systematic review has shown that students and parents are severely affected by DM in Saudi Arabia and this has been increasing over the years. [3]

It has been reported that the prevalence of Type 2 diabetes mellitus (T2DM) among geriatric patients in the Arab countries of the Gulf Cooperation Council (GCC) is higher than the developed counties. The prevalence rate in Saudi Arabia is 16.8%, Bahrain 15.4%, Kuwait 14.6%, Oman 13.4%, the United Arab Emirates (UAE) 18.7%, and Qatar 15.4% [4], whereas, in some developed countries like the USA, the prevalence rate is 9.9%, [5] and in the UK it is 6%. [6] Kingdom of Saudi Arabia (KSA) has a high prevalence rate of obesity of 40%, hypertension of 30%, and coronary artery disease of 6.2% [7].

Pharmacist intervention has satisfactory effects on therapeutic, safety, hospitalization, and adherence outcomes in older patients. Pharmacists should be involved in team-based care of older patients [8]. Unfortunately, there are limited studies regarding the pharmacist interventions on medication adherence and patients' knowledge among T2DM Saudi Arabian elderly patients. A recent study without pharmacist intervention has shown that

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32% of patients have reported that they skipped dosage during the past three days of treatment [9]. In another study, conducted among epileptic patients in KSA it was shown that the pharmacist intervention has a positive impact on patients' adherence, patients' knowledge, and health outcomes [10].

This study aimed to investigate if the pharmacist counseling program has an impact on patient medication adherence and satisfaction of elderly diabetic patients in King Saud Hospital, Unaizah, Saudi Arabia. Moreover, it was aimed to investigate the impact of patients' adherence in HbA1c.

Patients and Methods

Study design

This comparative study used a longitudinal method to compare the patient's adherence before (pre-intervention period) and after the intervention (post-intervention period). This study was carried out in the diabetic clinic in a governmental hospital at King Saud Hospital, Unaizah city, in Saudi Arabia, over a period of eight months, starting from June 2015. We implemented a pre-test and post-test of two groups of patients using a self-administered questionnaire. All aspects of the study protocol, including accessed and used of the patient clinical information were authorized by the Medical Ethics Committee and the local health authorities before initiation of this study. The study was approved by the Qassim Research Ethics Committee and the Faculty of Pharmacy, Mara University of Technology. In order to evaluate adherence and satisfaction, we used Morisky Medication Adherence Scale-8 (MMAS-8) and Diabetes Medication Satisfaction (DiabMedSat) questionnaires, respectively.

study population

In this study, 102 patients were selected according to the following inclusion criteria: 1) Minimum of 60 years old; 2) any gender; 3) diagnosed with T2DM for more than 6 months; 4) willing to participate and have submitted written consent to participate in the study; and 5) Fasting plasma glucose (FPG) ≥ 7.0 mmol/l (126 mg/dl); 6) glycated hemoglobin (HbA1c) ≥ 6.5% / 48 mmol/mol; or 7) Random plasma glucose ≥ 11.1 mmol/l (200 mg/dl) in the presence of classical DM symptoms.

On the other hand, we excluded all patients with 1) type 1 DM; 2) gestational diabetic; 3) living outside Unaizah city; 4) unable to comply with the follow-up requirements; or 5) have not had HbA1c test in the prior year.

Sampling procedure

Random techniques and clinical results obtained from the hospital were used to ensure that accurate numbers are represented. The sample chosen was used to represent the given population in the study and to generalize the research findings. Random sampling techniques are the most accessible method where every elderly patient has an equal chance of being included in the study. A simple random selection may be accomplished in several ways including drawing names or numbers out of the box or by using a computer program to generate a sample using random numbers. This study selected the patients by assessing the T2DM file from the clinic and selected every third patient that appeared in the patients' files in the diabetic clinic of King Saud Hospital, in Unaizah City. The records showed that about 1,800 patients receive medication from King Saud Hospital monthly. Yearly, approximately 6,609 patients receive medication from the hospital, which constitutes 697 elderly. In this study, 102 patients were selected who aged above 60 years old and were on regular care medication on T2DM.

Study intervention

The program was aimed at improving the knowledge of the pharmacist specifically for T2DM patients. The training program included all pharmacists who worked at outpatients' care that were recruited into the study. The researcher selected all those pharmacists because they were working at the outpatient department and responsible for counseling and recommendation of medication in the hospital. The outpatients' pharmacist received a total of ten hours of modules to improve the medication adherence and health status of the elderly with T2DM.

This is an in-service training program adapted from an established certified Medication Therapy Adherence Clinic (MTAC) program for pharmacists in Malaysia. The contents of the educational materials were customized to include issues on medication adherence on elderly diabetic patients. The materials were delivered through informative lectures, demonstrations, and experimental learning components including hands-on attachments at specific diabetic clinics. Posters and leaflets were also distributed to explain the major issue of the research in one paper. The program was delivered within five days over a total of 10 contact hours. Details on the improving lecture topics are provided in Table 1.

Patient adherence evaluation

MMAS-8 questionnaire was used to evaluate the patient's medication adherence in the present study consisting of eight questions, where, the total score was 8 and the adherence levels for the patients were classified into low adherence (score = <6), moderate adherence (score = 6-<8), and high adherence (score = 8). The patient medication adherence was evaluated in two stages, which were pre-test before the intervention program and post-test after the intervention program.

Patient's satisfaction

In this study, satisfaction was measured using the DiabMedSat questionnaire. This questionnaire consists of six questions, where, the scores are transformed on a 0 to 100 point scale with higher scores indicating greater satisfaction. The patient satisfaction was evaluated in two stages, which were pre-test before the intervention program and post-test after the intervention program.

Statistical analysis

Data were analyzed through Statistical Package for Social Science (SPSS) for Windows, version 22.0. The level of statistical significance was set at $p<0.05$ for all analyses. The data exploration was performed prior to determining the missing values and the normality of the variables. Furthermore, the independent t-test was used to determine the existing coefficient and to identify any relationships between continuous adherence scores and HbA1c results, as well as between other continuous demographic and diabetes-related variables. Both descriptive

and inferential statistics were used in the process of data analysis. The data were analyzed using both independent sample t-test and ANOVA to investigate if there are any significant differences between the variables.

Results

Demographic data

The socio-demographic characteristics of the patients in accordance with their different age, gender, marital status, education, monthly incomes, and smoking status were summarized in Table 2.

The impacts of the intervention program on patient medication adherence

MMAS-8 was applied in the present study to demonstrate the patient's medication adherence level, where 102 elderly patients answered the questions concerning medications. The mean total score of pre-MMAS-8 was 4.15±0.85. The mean total score of post-MMAS-8 was 5.67±0.51. All patients appeared to have low medication adherence in pre-MMAS-8 (*n*=102, 100.0%), while in the post-MMAS-8, 90 patients (88.2%) had low medication adherence and 12 (11.8%) patients demonstrated medium adherence, as illustrated in Table 3.

In this study, the mean MMAS-8 score of the study population was 102, with the mean of 4.10 and 5.67, respectively, in both pre-test and post-test (p=0.001). The categories of the medical adherence were grouped into three levels corresponding to a specific percentage, as shown in Table 4. The level of adherence after the intervention program showed 88.2% of patients had a low adherence level and 11.8% had a moderate adherence level. It means that 11.8% of the patients had improved their adherence to the medication treatments given to them.

The impact of intervention on HbA1c level

The analysis presented in Table 5 shows that there was a significant difference in the lab test in patients before and after the intervention. The results showed significant changes in patients in terms of their HbA1c and others. Only DBP (diastolic blood pressure) and total cholesterol did not show any changes. HbA1c is categorized into two different categories, which are good and poor controls. Statistically differences were observed between pre- and post-test HbA1c (p<0.001), where 40% of good control HbA1c recorded before the intervention increased to 60% after the intervention program.

The impact of patients medication adherence on hba1c level

The mean adherence score of good glycaemic control was 5.68±0.30, while the mean adherence of poor glycaemic control was 5.66±0.55. Therefore, our analysis showed that there was no significant relationship between HbA1c and the patients' medical adherence with p > 0.878.

The impact of intervention program on patient's satisfaction

The analysis provided in Table 6 focused on the satisfaction of the elderly with T2DM. The results of the patient's satisfaction with the treatments before and after the intervention program were categorized into three levels. In terms of all different dimensions of the satisfaction mentioned, the significant difference was observed for all.

The association between patient's gender and study's objectives

The result indicated that males and females that participated in this study were significantly different in terms of their medication adherence (p= 0.047), satisfaction (p= 0.038), and HbA1c level (p <0.001), as presented in Table 7.

The association between patient's education levels and study's objectives

There was a significant difference between the patients' education level and their adherence and satisfaction in the post-test with p=0.003 and p=0.017, respectively. However, the difference was not significant regarding the HbA1c post-test with p=0.810. Post-hoc analysis was summarized in Table S1:S3.

The association between patients' comorbidities and study's objectives

The analysis showed that there was no association between the patients' medication adherence post-test and comorbidities (p > 0.05). However, we found that there was a significant association between medication satisfaction and comorbidities (p= 0.021) and between the patient's HbA1c level and comorbidities (p=0.001). Post-hoc analysis was reported in Table S4.

Discussion

This study showed that T2DM medication improves as the patient's adherence to the prescription giving by the pharmacist after the post-test. The intervention program significantly improved medication adherence of the elderly with T2DM. The result of this study was comparable with the results of several studies [11–15]. Furthermore, this finding is supported by a previous study that showed patients adherence to medication improved health inclusive treatment with oral monotherapy [16].

Clinical outcomes of the patients measured based on good and poor glycaemic control showed no significant difference in HbA1c. Good control was more than poor control based on the adherence score. The mean score was based on the statistical inference of the measured variables. The analysis was based on the data from the laboratory result of T2DM in elderly patients. The results complied with previous studies that showed no significant difference between the patient's adherence and clinical outcome. [17,18] Therefore the present study supports the existing study findings on the relationship between the patient's adherence and clinical outcomes.

The pre- and post-test analyses showed significant improvement in the patient's satisfaction. This implies that the intervention program initiated in this study can make a long-time impact on the patient's health awareness and to be more satisfied among the elderly with T2DM across Saudi Arabia. Patient's satisfaction towards diabetic treatment for pre- and post-intervention showed a significant improvement after the intervention program. This implies that patients were impressed by the medication because they were more consistent in adhering

to the medication prescription. The finding of the present study is similar to the results of other studies [19,20].

The association between medication adherence and HbA1c

The correlation analysis between medication adherence and HbA1c in the present study revealed a non-significant correlation. However, the patients who exhibited a higher adherence rate showed better glycaemic control than those with low adherence rate but the differences between those patients were not significant, this could be attributed to the MMAS-8 might not provide the real adherence status of those patients. Moreover, the researcher might be bias during the filling of the MMAS-8 questionnaire. The present study was single-center research that could not provide the exact relationship between medication adherence and HbA1c. Additionally, this eight-month study is still not enough to discover the improvement of the HbA1c level and requires longer period of monitoring. The finding of the present study is consistent with other studies that showed non-significant association between medication adherence and the Hba1c level [21–24]. On the other hand, there are also other studies that revealed significant association between medication adherence and HbA1c [25–27].

The association between gender and study objectives

Our study showed that the association between gender and medication adherence was significant with P<0.05. However, the males had more adherence than the females and this could be attributed to the fact that the females in Saudi Arabia have been engaged with housework. Many studies have revealed results similar to the findings of the present study [28,29]. In this study, the association between gender and satisfaction was significant with P<0.05. However, the males were more satisfied than the females, which may be due to the fact that the males in Saudi Arabia have the ability to organize their lifestyle according to their medication than females. Many studies have revealed results similar to the findings of the present study [30,31].

The association between the level of education and study objectives

The education level of the patients had a significant positive impact on medication adherence and that was shown in the present study where the patients with higher educational levels had sufficiently adhered to their medication with P<0.05. As mentioned previously, this association was a result of the positive effect of education level on the magnitude of knowledge that patients will have, which in turn, will reflect a better medication adherence. The result of this study is compatible with the results of other studies that revealed the significant association between education level and medication adherence of the patients [32,33].

The results of the present study showed that the satisfaction from the medication was affected by the patient's education level, where the difference between the patient's satisfaction of medication and the level of education showed significant difference at P<0.05. This could be attributed to the impact of education level on the patients thinking behavior, where patients with higher education levels were more aware of their health condition. Several studies had demonstrated results similar to the result of the present study [34–36].

The association between comorbidities with study objectives

The present study showed that the association between the knowledge of the elderly with T2DM and their comorbidities was not significant, which means that there was no impact of these comorbidities on patients' adherence. The number of comorbidities and the nature of these comorbidities did not affect adherence. Moreover, some studies reported comorbidities did not affect patient's medication adherence, where it was suggested that adherence depends on the nature of the comorbidity since some comorbidities require regular medication consumption and might not affect the adherence level [37]. On the other hand, various studies reported the presence of concomitant medical conditions or comorbidities to have a negative effect on medication adherence [38,39].

We found that the relationship between the satisfaction of the older people with T2DM and their comorbidities was significant, which means that there was a negative impact of these comorbidities on the patients' satisfaction. Furthermore, this finding was consistent with other studies that found DM patient's satisfaction significantly associated with their comorbidities [34,35].

Limitation of the study

The study has several limitations that need to be acknowledged. The first is that this study only targeted the elderly with T2DM in Unaizah City Clinic Saudi Arabia, which did not represent all Saudi Arabia elderly patients with diabetes. However, the sample size was large enough to represent all diabetic patients managed in the outpatient clinic of the hospital in that city. The study only evaluated the adherence to diabetes medication and did not evaluate the overall rate of adherence to all medications used by the patients. However, the total number of medications in patient prescriptions was recorded and found to be associated with reduced adherence to diabetes medication.

Conclusion

Despite the gaps associated with differences in gender, education level, and comorbidities among the elderly with T2DM, the current study has shown significant information supported by literature studies. Gender was significantly associated with medication adherence, satisfaction, and HbA1c level. The intervention program has improved medication adherence, satisfaction, and HbA1c level among elderly patients with T2DM. The improvement in medication adherence, satisfaction, and HbA1c level shows the important roles of the pharmacist in the patient's health management process.

Recommendations

The approach reported in this study can be replicated across Arab countries to improve the health condition of old people with T2DM. This is possible because of the common culture shared among the region. However, some issues related to T2DM can be addressed by focusing on implementing a novel MTAP-diabetic geriatric patients Medication Therapy adherence program. In addition, the impact of intervention training of the

pharmacist program at the diabetic clinic in King Saud Hospital, Unaizah city in Saudi Arabia is an important step to combat T2DM.

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Table 1: Lecture Modules for Medication Therapy Adherence

Modules	Learning objective	Method of delivery	Duration
1-Diabetic guidelines	Highlights guideline for DM, and guideline for elderly diabetic patients.	Lecture/discussion	2 hours
2-Diabetic Highlights	Diabetes counseling counseling protocol of elderly patients.	Lecture/discussion	2 hours
3-Clinical practice	Highlights of DM comprehensive care plan.	Lecture/discussion	2 hours
4-Adherence	Highlights MTAC: diabetes for elderly to educate patients with diabetes, Self-Management Education and support	Lecture/discussion	2 hours
5- Case studies	Presents case on elderly with T2DM	Lecture/discussion	2 hours
6-Tips for elderly with T2DM	Highlights Medication use Complication	Lecture/hand out	1 hour

Table 2: The Demographic Background of the Patients in terms of their Age, Gender, Status, Education Monthly incomes, and Smoking Status (n= 102)

Patients Demographic Variables		Frequency n (%)
Age (years)	61-70	83 (81.4)
	71-80	9 (8.8)
	81-90	9 (8.8)
	≥ 91	1 (1.0)
Gender	Male	75 (73.5)
	Female	27 (26.5)
Marital status	Single	2 (2.0)
	Married	98 (96.1)
	Widowed/divorcee	2 (2.0)
Education	No formal education	16 (15.7)
	Primary	22 (21.6)
	Secondary	23 (22.5)
	Tertiary	41 (40.2)
Monthly income	<SAR3000	15 (14.7)
	SAR3001-SAR5000	18 (17.6)
	SAR5001-SAR7000	22 (21.6)
	>SAR7000	47 (46.1)
Smoking status	Current smoker	19 (18.6)
	Ex-smoker	10 (9.8)
	Never smoked	73 (71.6)
Accompanying person	None	55 (53.9)
	Spouse	6 (5.9)
	Children	28 (27.5)
	Others	13 (12.7)
Seen Diabetes Educator	Yes	62 (60.8)
	No	40 (39.2)
Seen Nutritionist	Yes	6 (5.9)
	No	96 (94.1)
Co-morbidities	Hypertension	54 (52.9)
	Asthma	5 (4.9)
	Hyperlipidemia	10 (9.8)
	More than one disease	33 (32.4)
BMI	Underweight	0 (0)
	Normal Weight	24 (23.5)
	Overweight	42 (41.2)
	Obese	36 (35.3)
Patients Demographic Variables		Frequency n (%)

BMI: Body Mass Index; SAR: Saudi Arabia Riyal

Table 3: Description of MMAS-8 Reported by the Patients

MMAS-8		Frequency of patients reported Yes, *n* (%)		p-value
		Pre Morisky	Post Morisky	
Do you sometimes forget to take your diabetic pills?		102 (100.0%)	77 (75.5%)	N/A
People sometimes miss taking their medications for reasons other than forgetting. Thinking over the past two weeks, were there any days when you did not take your [health concern] medication(s)?		24 (23.5%)	6 (5.9%)	0.624**
Have you ever cut back or stopped taking your medication(s) without telling your doctor, because you felt worse when you took it?		9 (8.8 %)	102 (100.0%)	N/A
When you travel or leave home, do you sometimes forget to bring along your [health concern] medication(s)?		70 (68.6%)	15 (14.7%)	0.002**
Did you take your [health concern] medication(s) yesterday?		94 (92.2%)	102 (100.0%)	N/A
When you feel like your [health concern] is under control, do you sometimes stop taking your medication(s)?		33 (32.4%)	7 (6.9%)	0.209**
Taking medication(s) every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your [health concern] treatment plan?		94 (92.2%)	99 (97.1%)	1.0**
How often do you have difficulty remembering to take all your medication(s)?	Never /Rarely	0 (0.0%)	0 (0.0%)	N/A
	Once a while	6 (5.9%)	70 (68.6%)	
	Sometimes	85 (83.3%)	32 (31.4%)	
	Usually	7 (6.9%)	0 (0.0%)	
	All the times	4 (3.9%)	0 (0.0%)	

** Fisher's exact test, N/A: Not Applicable (no statistics are computed because questions are constant)

Table 4: Categorical Levels of Medical Adherence

Medical Adherence	Pre- test (%)	Post- test (%)
Low Adherence (<6)	100	88.2
Moderate Adherence (6 to <8)	0	11.8
High Adherence (= 8)	0	0

Table 5: Laboratory findings of the study; pre- and post-intervention.

Parameter	Pre-intervention Mean± SD	Post-intervention Mean± SD	P-value
RPG (mg/dL)	244.64±74.95	218.42±56.61	0.001
SBP (mmHg)	135.64±12.50	132.70±9.48	0.002
DBP (mmHg)	81.03±4.74	80.49±2.17	0.206
HbA1c (%)	7.87±1.19	7.55±0.99	0.001
FPG (mg/dL)	173.15±51.67	155.29±37.61	0.001
Tot. Cholesterol	4.71±1.08	4.66±0.95	0.174
LDL (mmol/L)	2.97±1.15	3.18±1.07	0.001
HDL (mmol/L)	1.40±0.79	1.43±0.69	0.001
TG (mmol/L)	1.62±0.58	1.73±0.58	0.003

*Date were presented as Mean±SD
HDL: high-density lipoproteins, LDL: low-density lipoproteins, RPG: Random Plasma Glucose, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HbA1c: Hemoglobin A1C, FPG: Fasting plasma glucose, TG: Total glycerides

Table 6: Patient's Satisfaction towards Diabetic Treatment, Pre and Post Intervention

Variables	Mean±SD	P-value
Pre Burden	47.39±11.95	0.001
Post Burden	53.76±9.90	
Pre Efficacy	52.34±11.39	0.001
Post Efficacy	56.31±9.74	
Pre Symptoms	47.67±13.99	0.001
Post Symptoms	53.29±13.15	
Pre Total Satisfaction	49.13±11.01	0.001
Post Total Satisfaction	54.45±9.19	

*Independent t-test

Table 7: The Significant Difference in the Study's Objectives' Post-Test and their Gender

Study objectives	Mean difference	P- value
Medication adherence	-0.15704	0.047
Satisfaction	8.350	0.038
HbA1c	0.187	<0.001

*Independent t-test

Table S1: The Association between the Level of Education and Post-Study Objectives Tests

	Study's objectives	P- value
Level of education	Medication adherence	0.003
	Medication satisfaction	0.017
	HbA1c	0.810

*One-way ANOVA

Table S2: Multiple Comparisons of Level of Education with Post-test satisfaction

Education level		Mean Difference	P-value
No formal education	Primary	-5.39121	0.257
	Secondary education	-2.05585	0.892
	Tertiary education	-7.46244*	0.027
Primary	No formal education	5.39121	0.257
	Secondary education	3.33536	0.590
	Tertiary education	-2.07123	0.813
Secondary education	No formal education	2.05585	0.892
	Primary	-3.33536	0.590
	Tertiary education	-5.40659	0.096
Tertiary education	No formal education	7.46244*	0.027
	Primary	2.07123	0.813
	Secondary education	5.40659	0.096

*One-way ANOVA with Tukey Post- HOC Test

Table S3: Table Multiple Comparisons of the Level of Education with Post-Test MMAS-8

Education Level		Mean Difference	P-value
No formal education	Primary	-0.17045	0.713
	Secondary education	-0.5707*	0.003
	Tertiary education	-0.32622	0.113
Primary	No formal education	0.17045	0.713
	Secondary education	-0.4002*	0.035
	Tertiary education	-0.15576	0.624
Secondary education	No formal education	0.57065*	0.003
	Primary	0.40020*	0.035
	Tertiary education	0.24443	0.226
Tertiary education	No formal education	0.32622	0.113
	Primary	0.15576	0.624
	Secondary education	-0.24443	0.226

*One-way ANOVA with Tukey Post- HOC Test

Table S4: The Association between Comorbidities and Post-Study Objectives Tests

	Study's objectives	P- value
comorbidities	Medication adherence	0.270
	Medication satisfaction	0.021
	HbA1c	0.001

*One-way ANOVA