Journal of Natural Sciences Research www.iiste.org
ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)
Vol.8, No.16, 2018

Application of Profile Analysis to the Fasting Blood Sugar levels of diabetics patients

Jean Pierre Namahoro*[1], Jean Bosco Nshimiyimana[2], Huang Jing hua[1]

1.School of Physics and Mathematics, China University of Geoscience (Wuhan), Wuhan 430074, Hubei, P. R. China.

2. Department of Biochemistry and Molecular Biology, School of Life Sciences, Central China Normal University, Wuhan 430079, Hubei, P. R. China.

*Corresponding Author: jpnama1991@yahoo.com

Abstract

The main purpose of the study was to investigate the fasting of blood sugar (FBS) levels fluctuation over time and the effect of some plausible factors on this change for Diabetic's patients on treatment and Balanced Diet (BD). To this end, we analyzed the FBS levels in both gender and age groups by using profile analysis to study the patterns of their changes. In this study, we used Retrospective data from Rwanda Diabetics Association (RDA) containing patient's FBS level, gender and age data, regularly obtained every three months. The MANOVA test of parallelism on treatment and BD showed at 5% significance level that the profiles in gender and age groups were parallel. The distance between profiles was not significant, but not flat. The analysis revealed that although the treatment remained effective, the trends of FBS levels over time were quadratic in treatments and BD. Furthermore, the rates of FBS change on treatment and BD were a function of time. These models and rates indicated that only treatment have the positive impact on FBS level while the BD has no effect.

Keywords: FBS level, Balanced Diet, trend model

1. Introduction

Diabetes mellitus is one of the most dangerous disease characterized by the lack of ability to regulate blood sugar levels of the body, resulting in chronically increased blood sugar levels, or hyperglycemia. Diabetes has two types: Type 1 and Type 2, People who have Type 1 diabetes do not produce insulin which converts blood sugar and starches into energy and type 1 diabetes used to be called juvenile onset diabetes because it is usually diagnosed in adolescence. Type 2 diabetes mellitus, the most common form of diabetes, results from an imbalance between insulin sensitivity and insulin secretion and comprises 90% of people with diabetes around the world while type 1 comprises 10% (Wang, Sun et al. 2014). In the past years, the global rise in non-communicable diseases (NCDs) represented one of the major health and socioeconomic threats in the 21st century. Among NCDs, diabetes mellitus remains a tragically diseases because of its prevalence and the related complications worldwide(Garg, Bantle et al. 1994). In sub-Saharan Africa, while communicable diseases such as HIV/AIDS, malaria, and tuberculosis have continued to provoke great threats to the public health system, it is

now shown that NCDs such as diabetes are undoubtedly adding to the multiple burdens for people in this region(Liu, Fu et al. 2010). In the research conducted in 2010 by Shaw about diabetes and its complications has revealed that the prevalence of diabetes among adults between 20 and 79 ages old was found to be 6.4%, affecting 285 million adults all over the world (Shaw, Sicree et al. 2010). Likewise the research conducted in Kigali University Teaching Hospital (CHUK) in 2012 has shown that out of 294 patients (104 males and 190 females) constituted the study population, 70 (24%) were diagnosed with type 1 while 224 (76%) had type 2 diabetes(Rudasingwa, Amendezo et al. 2012). On the other hand, the research carried out at Ketu-South Municipality in Ghana about the prevalence of type 2 diabetes showed that the FBS level for 80 diabetic patients on drug was containing 23.75% suggesting that aging increases the chances of having diabetes of type 2 and females (67.5%) were almost twice as the males (32.5%). The high number of females was compared to males and due to the higher physical activity-related consuming the energy in males compared to female subjects, so decrease the rate of males living with type 2 diabetes. The low level of diabetes-related health expenditures has prevented a very small proportion (0.06%) of diabetes-related deaths. Increased funding for cost-effective diabetes prevention and treatment is a need (Adampah, Luguterah et al.). Similar conclusions were made by(Scavini, Stidley et al. 2003) who found that the prevalence of diabetes was 57% higher among females than male members of the population.

In 2011, there were approximately 180 million people worldwide with diabetes and its complications (Tuei, Maiyoh et al. 2010). In 2000, WHO showed that 7020000 of people were lived with diabetes in Africa(Wild, Roglic et al. 2004). Rwanda had 30000 lived with diabetes at that time and was subjected to a yearly increase. To decrease its rate, regular physical activity was strongly recommended for people with diabetes to improve their fasting blood sugar level control, insulin sensitivity, prevention and reduction of morbidities and complications (Kabanda and Phillips 2011).Progressively, Rwanda is becoming one of the fastest developing countries in Africa. However, the management of economic development for local people is not yet standardized(Giddens 2018). This fact leads to the increment of diabetics due to the low economic development which limits the affordability of treatment and accessibility of health facilities(Phelos 2017). Therefore, some diabetics have been assigned to treatments and others to BD according to their fasting blood sugar level. Furthermore, diabetics are likely to occur in many populations and at an early stage. By reflecting to that issues, this research comprises techniques to analyze the fasting blood sugar level for diabetic's patients by applying profile analysis.

1.1. Profile Analysis

Generally, the profile analysis is a multivariate tool for analyzing the profile of variables across groups especially for repeated measures or mixed ANOVA, and also is a multivariate approach which uses separate correlated response variables. It is normally used in different kind of data. Mostly for these two different types that are measured over time: time series, which takes many measurements on a small set of individuals, and longitudinal data, which takes a small number of measurements on a large number of individuals. It deals with three tests: Test of Parallelism, Test of Levels (Separation) and Test of Flatness. The main test is to know if the profiles of group levels are parallel, are at the same level and are flat. Profile analysis asks three basic questions about the data plots:

- Are the groups parallel between time points?
- Are the groups at equal levels across time points?
- Do the profiles are flatness across time points?

If the answer to any of these hypothesized questing is no i.e. that specific null hypothesis is rejected, then there is a significant effect. The type of effect depends on which of these null hypotheses is rejected.

This hypothesis can be written mathematically as follow:

H_0: Are the profiles similar in the sense of being parallel?

H_1: $\mu_{1,j} - \mu_{1,j-1} = \mu_{2,j} - \mu_{2,j-1}$ for j= 1, 2, 3…p where p is the set of measurements and $\mu_{1,j}$ is the means of each group.

H_0: Are they at the same level?

H_2: $\frac{\mu_{1,1}+\mu_{1;2}+\cdots\mu_{1,p}}{p} = \frac{\mu_{2,1}+\mu_{2,2}+\cdots+\mu_{2,p}}{p}$

The same level means within groups are on the same line.

H_0: Are they flat?

H_3: $\frac{\mu_{1.1}-\mu_{1,2}}{2} = \frac{\mu_{1,2}-\mu_{2,2}}{2} = \cdots = \frac{\mu_{1,P}-\mu_{2,P}}{2}$

The flatness means that the profiles are horizontal.

The analysis of these hypotheses is based on the Hotelling's test (T^2). The Hotelling test (T^2) is used to test whether the population means of the K+1 random vectors and response variable are equal. The rejection of the null hypothesis is when $\mathbf{T^2 > \chi^2 (\alpha).}$ This test is exactly chi-square distributed with p degree of freedom. For small samples, the chi-square approximation to T^2 does not take into account variation due to estimating the samples variance-covariance matrix **S (Morrison 2005)**.

Therefore, better result be obtained from the transformation of the Hotelling's test (T^2) statistic to F statistic as follow: $F = \frac{n-p-1}{p(n-1)} * T^2$ and was compared with **P-value** generated by the software where n-1 is a degree of freedom, and p indicating measurement recorded.

2. Methods

The design of this study is repeated measures for longitudinal second data that have been provided by RDA in the group of Gender (male and female) and Age (under forty and above forty years old) in 2015.The process of obtaining the data was authorized by RDA and UR University, College of Science and Technology (SCT). In this research 152 individuals were enough to analyze the change of FBS level of diabetic patients. 76 individuals assigned to treatment and 76 individuals for BD by random samples. SSPS software has been used to analyze the data and manually calculation of some parameters in the model. The MANOVA was used to show the effect of treatment and BD on the FBS level in the interval of time of t= 0, 3, 6 months and the profile plots and tests also

have been used to show the pattern effect of both treatment and BD. This research was based on this hypothesis of interest:

H_0: There is no significance effect of treatment or BD on FBS level in groups of patients.

H_1: There is an effect of treatment and BD on FBS level in a group of patients.

The application of profile analysis enclosed all analysis and interpretation of data and answer the above hypothesis.

3. Results

This following analysis was based by applying the transformation of the Hotelling's test (T^2) statistic into F-statistic as follow: $F = \frac{n-p-1}{p(n-1)} * T^2$ and compared with P-value generated by the software, and F- value generated by the software did not take into account only T^2 and P-value were used in this analysis.

3.1. Descriptive statistics

The females and males were equal and the mean change in FBS level for males before taking treatment for diabetics was 281.11 mg/dl whiles that of the females was 239.11 mg/dl. After taking first and second treatments for, FBS level was 77.76 mg/dl and 81.39 mg/dl respectively. While for the diabetics patients under forty years old before taking first treatment FBS level were 263.54 mg/dl and for patients above thirty nine years old were 258.52 mg/dl. After taking the second and third treatments, the mean changed to 79.58 mg/dl. The standard deviation decline at high rate that implies high deviation of FBS level with presence of treatment.

The females and males were not equal and the mean of FBS level for males and females before guided to take BD (balanced diet) for diabetics was 273.32 mg/dl mg/dl and 223.39mg/dl respectively. After taking second and third BD, the means of FBS level were 248.03 mg/dl and

271.51 mg/dl respectively. The mean of FBS level for under forty years old and above after guided to take first and second BD for diabetics was 260.44 mg/dl and 276.94 mg/dl respectively. The standard deviation are too big that implies slow change of FBS level. Throughout the BD, the means of FBS level of patients does not decrease at a significance rate which shows that BD cannot affect FBS level. The standard deviation is too big implies slow deviation of FBS level **(Table 1).**

3.2. Profile plots of FBS in Age and Gender on treatment

The pattern of change in FBS level over the period of observation for group of age were showed that both below 40 years old and above 40 initially Were at high level sharply but group 1 was above of group 2 at t_1, both declined at the same rate until t_2 and after that, both seem to be also changing in almost the same pattern and met on t_3 (**Figure 1)** and then the profiles are seemed parallel and flatness. In gender, profiles showed that both sexes initially Were at high level sharply but males were above of females at t_1, both declined but males declined at high rate than females until t_2 and after that, both seemed to be changing in almost the same pattern but with the males almost greater than females up to t_3 and showed that the profiles are parallel means the distance between profiles is not significance but not flat **(Figure 2).**

3.3. Profile plot of FBS in Age and Gender on BD

The pattern of change in FBS level over the period of observation for age group was shown that both initially decreased sharply in the different rate from t_1 up to t_2 but group 1 decrease at a high rate than group 2. Group 1 was at the highest level than group 2 at t_1, and then both seem to be increasing in almost the same pattern up to t_3. So the profiles seemed parallel and flatness **(Figure 3).** For gender, the profiles showed that initially, a group of males decreased while a group of female increased sharply in almost the same rate but in opposite directions. Males were at the highest level than females at t_1, and that of the females increased at a high rate than males until t_2 and after that, both seemed to be changing in almost the same pattern up to t_3 **(Figure 4).**

3.4. Test for parallelism, flat and at the same level on treatment

The hotelling's test for parallelism in gender groups is $T^2 = 0.025$. F-test was calculated and is equal to F statistic: F (3, 72) = 0.0081. The hypothesis H_0 is failed to be rejected at 5% significance level since P −value is greater than F (3, 72) = 0.416 The hoteling's test for parallelism in age groups was $T^2 = 0.002$. F-test was calculated and is equal to F statistic: F (3, 72) = 0.00064. The hypothesis H_0: the vectors are parallel for two groups (under 40 years and 40 and above years), did not rejected at 5% significance level since P−value is greater than F (3, 72)= 0.918. Generally, these profiles either in gender and age groups are parallel since the null hypotheses did not rejected. So there is no interaction effect of time and groups **(Table 2).**

The hotelling's test for flatness in gender groups is $T^2 = 1.237$. F statistic: F (3, 72) = 0.401. The hypothesis H_0 is rejected at the 5% significance level since P −value is less than F (3, 72) = 0.00. The hotelling's test for flatness in age groups was $T^2 = 1.074$. F-test was calculated and is equal to F statistic: F (3, 72) = 0.348. The hypothesis H0: the vectors are flatness for two groups (under 40 years and 40 and above years), is rejected at 5% significance level since P −value is less than F(3, 72) = 0.00. Generally, all null hypotheses are rejected that implies that the profiles are not flat. So they are not horizontal **(Table 3).**

According to the results in **Table 4**, Hotelling test for the same level, the null hypotheses is failed to be rejected since P −value is greater than significance level = 0.05. So all profiles are on the same line.

3.5. Test for parallelism, flat and at the same level on BD

The hotelling's test for parallelism in gender groups is T^2 =0.034. F-test was calculated and is equal to F statistic: F (3, 72) = 0.011. The hypothesis H_0 is failed to be rejected at the 5% significance level since P −value is greater than F (3, 72) = 0.4301. For age groups was $T^2 = 0.014$. F-test was calculated and is equal to F statistic: F (3, 72) = 0.0045. The hypothesis H_0: the vectors are parallel for two groups (under 40 years and 40 and above years), did not rejected at 5% significance level since P−value is greater than F (3, 72) = 0.611. Generally, these profiles either in gender and age groups are parallel since the null hypotheses did not rejected. So there is no interaction effect of time and groups **(Table 5).**

The hoteling's test for flatness in gender groups is $T^2 = 0.293$. F-test was calculated and is equal to F statistic: F (3, 72) = 0.095. The hypothesis H_0 is rejected at the 5% significance level since P −value is less than F (3, 72) = 0.00. For in age groups was $T^2 = 0.293$. F-test was calculated and is equal to F statistic: 0.095.The hypothesis H_0: the vectors are flatness for two groups (under 40 years and 40 and above years), is rejected at 5% significance

level since P −value is less than F(3,72)= 0.00. Generally, all null hypotheses are rejected implies that the profiles are not flat. So they are not horizontal **(Table 6).**

According to the results in **table 7**, the null hypotheses are failed to be rejected since P −value is greater than significance level = 0.05. So all profiles are on the same line.

Interpretation: According to the MANOVA test for the parallelism, all profiles plot in gender and age are parallel on treatment and BD. The flatness failed and the profiles are on the same line, implies that the distance between profiles is not significance.

3.6. Fitted mathematical models

The linear model and quadratic model are significance to describe the change of FBS level with respect to the time interval in which the patients had been taking the treatment and requested to take BD but according to the coefficient of determination (R square), the quadratic model was appropriate. The averaged quadratic model has been tested by heteroscedasticity residuals test and showed that R^2 = 0.889 on treatment and R^2 = 0.711 on BD. The fitted model that describing the change in FBS level is shown as follow: The analysis revealed that although the treatment remained effective, the trend of FBS level over time was quadratic, indicating that initially the FBS level usually increases with time and then also increases with time. The quadratic profile trend obtained was FBS (t) = $0.44t^2$ +3.173t. And also the rate of change of FBS on treatment was $\frac{d(FBS(t))}{dt} = 0.88t + 3.173$ which increased over time. The positive sign of the estimate coefficients indicates the positive effect of treatment of FBS level of the patients in the time interval. While for BD, the profile trend obtained was FBS (t) = − $0.688t^2$ −11.05t that showed the FBS declined over time and indicating no effect of BD on FBS, and the rate of change of FBS on BD was $\frac{d(FBS(t))}{dt} = -1.377t - 11.05$, which declined over time. The negative sign of this estimated parameter indicates the less impact of the BD on the FBS level of patients. Therefore these models and rates indicated that only treatment has the positive impact on diabetic's patients (**Table 8**). The ARCH-LM indicated that the residuals were free from conditional heteroscedasticity (p-value = 0.6051) for BD and (p-value= 0.7093) for treatments. Hence the diagnostic test revealed that the models are adequate for prediction of FBS level. The coefficients of determination (R^2 marked with start (*)) in **table 8** on treatment and BD also show that the parameters estimate are fit the models.

4. Discussion

The similar initial increase and then decline in the pattern of change of FBS levels over time for both sexes is an automatic indication that the treatment and management plans adopted to bring the situation under control were actually addressing the condition irrespective of gender even though performance is better in males than females, the same for BD effect on the FBS level. According to descriptive statistics, the females and males were equal and the mean change in FBS level after taking first and second treatments for, FBS level was 77.76 mg/dl and 81.39 mg/dl respectively. While age group after taking the second and third treatments, the mean changed to 79.58 mg/d. In gender group after taking second and third BD, the means of FBS level were 248.03 mg/dl and 271.51 mg/dl respectively. While the mean of FBS level for under forty years old and above after guided to take

first and second BD for diabetics was 260.44 mg/dl and 276.94 mg/dl respectively. The standard deviation for treatment decrease at higher rate while in BD standard deviation decrease at low rate (Table **1**). The Hotelling's test of parallelism, equality, and flatness, showed that the pattern for male and female patients is not only the same but also almost equal with the average of FBS level changing slowly over time, while gender did not affect the change in FBS level, time did and that there is no time and groups interaction. The multivariate test showed the greatest significance effect of treatment on the FBS level compared to the effect of BD **(Fig 1, 2, 3, and 5).** The profiling of the FBS level pattern of the different groups is also expressed and all the groups follow almost the same trend with respect to time on treatment and also follow the same pattern for BD that shows the BD has small effect on the FBS level **(Table 8).** The ARCH-LM Test for residuals of the quadratic models confirmed that these models are significantly reliable for estimating the FBS level of the patient's on treatment and on BD and this was different with the trend obtained by (Adampah, Luguterah et al.), may be was due to the length of the study period was different.

5. Conclusion

The mean change of FBS level of diabetics was at higher rate after taking treatment in gender and age group. While for those who take BD, the mean of FBS level slightly decrease with low rate and show that BD does not have impact on FBS level compared to treatment and confirmed by the standard deviation movements. The MANOVA test of parallelism showed that gender was parallel because there was not significant difference in the pattern of change of the FBS level. Age groups did not significantly differ at the 5% significance level and hence their profiles were tested for parallelism and flatness. The parallelism tests revealed that the profiles were parallel and equal but deviated from flatness for treatment but not equal and flat for BD. The model fitted of FBS level on the treatment indicated that treatment has positive effect and also indicted by rate of change of FBS level. While the fitted model on BD and rate of change indicted the negative effect. It is therefore indicated in the study that the treatments are improving the condition of living with diabetes for patients but BD has less contribution and indicated that the null hypothesis of the study has been rejected. From this rejection, we can say that diabetic's patients should take treatment rather than BD, for better more they can take both. This research did not cover all related angles due to different conditions. So I encourage other researchers to go beyond this application of profile analysis and use it in different areas.

6. Acknowledgment

I wish to extend my sincere heartfelt gratitude to my family for social, emotional, financial and spiritual support for accomplishing this study. Many thanks go to my supervisor Dr. Huang Jing Hua, who guided to arrange and finalize this paper from start to the end. And I give thinks to Dr. Joseph NZABANITA who guided me how to apply profile analysis in this study and provide the needed support and collaboration with Rwanda Association of Diabetes. A very big thank to the Rwanda Association for Diabetics (RDA), for its facility available to us for data collection in support of this study, may their kindness and contribution meet my sincere gratitude.

7. Funding information

Funding of this research is solely by the researchers.

8. Authors' contributions

All authors play almost equal role in preparing this manuscript. Corresponding Author contributed in data collection, analysis and interpretation. The other Authors contributed in organizing and preparation of this manuscript and financial support.

9. Conflict of Interest

The researchers have not conflict of interest whatever to declare as far as the preparation of this manuscript is concerned.

References

Adampah, T., A. Luguterah, S. D. Nyadanu and D. N. Nawumbeni "Longitudinal Study of Type-2-Diabetes: A Profile Analysis at the Ketu-South Municipality."

Garg, A., J. P. Bantle, R. R. Henry, A. M. Coulston, K. A. Griver, S. K. Raatz, L. Brinkley, Y. I. Chen, S. M. Grundy and B. A. Huet (1994). "Effects of varying carbohydrate content of diet in patients with non—insulin-dependent diabetes mellitus." Jama 271(18): 1421-1428.

Giddens, A. (2018). Globalization. Sociology of Globalization, Routledge: 19-26.

Kabanda, A. and J. Phillips (2011). "Physical activity among adults with diabetes mellitus in Rwanda: physical activity, health and wellness." African Journal for Physical Health Education, Recreation and Dance 17(2): 239-247.

Liu, Z., C. Fu, W. Wang and B. Xu (2010). "Prevalence of chronic complications of type 2 diabetes mellitus in outpatients-a cross-sectional hospital based survey in urban China." Health and Quality of Life Outcomes 8(1): 62.

Morrison, D. F. (2005). "Multivariate analysis of variance." Encyclopedia of biostatistics 5.

Phelos, H. (2017). Demographics, clinical measurements, and behavioral predictors of Type 1 Diabetes mortality in Rwandan adults, University of Pittsburgh.

Rudasingwa, G., E. Amendezo and M. Twagirumukiza (2012). "Clinical patterns and complications of African diabetic patients: Preliminary data from Kigali University Teaching Hospital, Rwanda." Afr J Diabetes Med 20(2).

Scavini, M., C. A. Stidley, V. O. Shah, A. S. Narva, F. Tentori, D. S. Kessler, A. Bobelu, C. P. Albert, J. Bobelu and E. Jamon (2003). "Prevalence of diabetes is higher among female than male Zuni Indians." Diabetes care 26(1): 55-60.

Shaw, J. E., R. A. Sicree and P. Z. Zimmet (2010). "Global estimates of the prevalence of diabetes for 2010 and 2030." Diabetes research and clinical practice 87(1): 4-14.

Tuei, V. C., G. K. Maiyoh and C. E. Ha (2010). "Type 2 diabetes mellitus and obesity in sub-Saharan Africa." Diabetes/metabolism research and reviews 26(6): 433-445.

Wang, T., P. Sun, L. Chen, Q. Huang, K. Chen, Q. Jia, Y. Li and H. Wang (2014). "Cinnamtannin D-1 protects pancreatic β-cells from palmitic acid-induced apoptosis by attenuating oxidative stress." Journal of agricultural and food chemistry 62(22): 5038-5045.

Wild, S., G. Roglic, A. Green, R. Sicree and H. King (2004). "Global prevalence of diabetes: estimates for the year 2000 and projections for 2030." Diabetes care 27(5): 1047-1053.

Tables

Table 5: Descriptive Statistics

Descriptive statistics			
treatment	Groups	Mean	Standard deviation
T1	Age 1	263.54	74.031
	2	258.52	210.801
T2	1	94.15	18.376
	2	91.54	16.190
T3	1	80.46	12.29
	2	19.58	10.902
T1	Gender/male	281.11	242.975
	female	239.11	68.748
T2	male	93.11	17.921
	female	92.00	17.061
T3	male	77.76	11.042
	female	81.39	11.396
BD1	Age 1	244.84	66.373
	2	250.08	69.835
BD2	1	241.36	62.474
	2	251.94	56.491
BD3	1	260.44	74.034
	2	276.94	69.776
BD1	Gender/male	273.32	66.588
	female	223.39	61.211
BD2	male	263.61	61.016
	female	262.45	51.788
BD3	male	292.97	65.865
	female	250.05	70.526

Table 2: MANOVA test using the Hotelling test for parallel on treatment

Effect	T^2-value	F	p-value >F
Age	0.002	0.086	0.918
Gender	0.025	0.899	0.416

Table 3: MANOVA test using the Hotelling test for flat on treatment

Group	T^2-value	F	P-value
Age	1.074	39.818	0.00
Gender	1.237	45.140	0.00

Table 4: MANOVA test using between-subjects effects on treatment test using

Group	M.S	F	P- value > F
Age	466.002	0.043	0.837
Gender	23428.318	1.06	0.285
Error	1542029.146		

Table 5: MANOVA test using the Hotelling test for parallel on BD

Effect	T^2-Value	F	P-value > F
Age	0.014	0.519	0.611
Gender	0.034	1.223	0.4301

Table 6: MANOVA test using the Hotelling test for flat on BD

Group	T^2-Value	F	P- value
Age	0.293	10.401	0.00
Gender	0.293	10.401	0.00

Table 7: MANOVA test using between-subjects effects on BD

Group	M.S	F	P- value > F
Age	6150.453	0.548	0.461
Gender	1041.99	1.049	0.351
Error	1987.537		

Table 8: Average Models

Effect	EQUATION	R-square	F	Df1	Df2	P- value	B1	B2
treatment	Linear	0.691	66.690	1	74	0.00	0.88	
	Quadratic	0.889*	52.443	1	74	0.00	3.173	0.44
BD	linear	0.341	18.981	1	74	0.00	-0.93	
	quadratic	0.711*	8.112	1	74	0.006	-11.05	-0.688

Figures

Figure 1. Profile plot of FBS level by Age groups on treatment

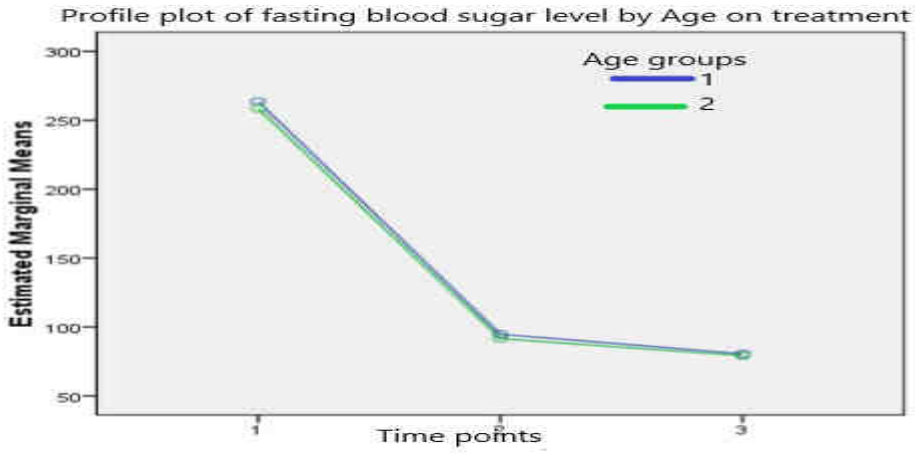

Figure 2. Profile plot of FBS by Gender on treatment

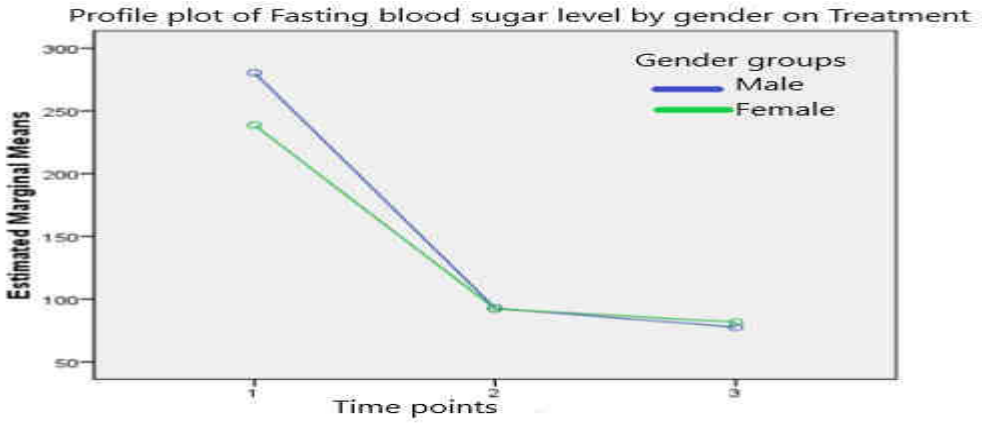

Figure 3. Profile plot of FBS by Age on BD

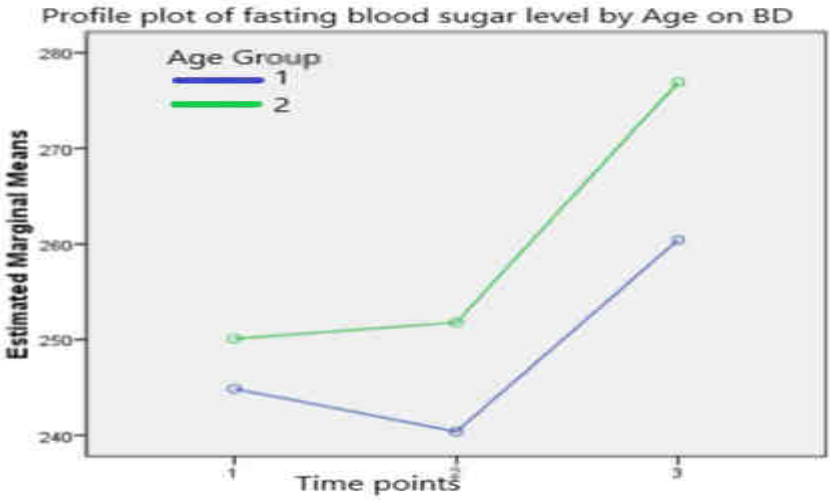

Figure 4. Profile plot of FBS by Gender on BD