

EFFECTIVENESS OF DIABETES SELF-MANAGEMENT EDUCATION (DSME) AND FAMILY-BASED INTERVENTIONS ON QUALITY OF LIFE IN PEOPLE WITH TYPE 2 DIABETES

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Abstract

Diabetes is a health condition that can have a significant impact on quality of life. Therefore, self-care management and family support may be important in helping people with diabetes maintain or improve their quality of life. The purpose of this study was to evaluate the effectiveness of the Diabetes Self-Management Education (DSME) program and family-based interventions in improving the quality of life of people with type 2 diabetes. This research was conducted using a quasi-experimental design with a one-group pre- and post-test. A sample of 54 individuals was selected using purposive sampling technique. Analysis was performed using dependent and independent t-tests. The results indicated that the DSME program was effective in improving quality of life in all domains ($p < 0.05$). Family-based interventions were shown to improve quality of life ($p = 0.045$) and psychological ($p = 0.010$) and environmental ($p = 0.029$) domains. However, the two interventions did not appear to differ in improving quality of life ($p_{\text{pre}} = 0.727$; $p_{\text{post}} = 0.466$). The study concluded that DSME and family-based interventions are effective in improving quality of life in people with type 2 diabetes. These interventions can be implemented in other health care settings.

Keywords: Diabetes Mellitus, Life Quality, Diabetes Self-Management Education, Family-Based Intervention

Introduction

Diabetes is a rapidly growing health problem, responsible for 43% of deaths worldwide, with a prevalence of 463 million in 2019 and an estimated 438 million people living with the disease by 2025 (1, 2). According to the Health Basic Research (RISKESDAS) 2018, the national prevalence of diabetes in Indonesia has increased from 1.2% to 1.4%. The South Sulawesi region also experienced an increase from 1.6% to 1.8% in people aged 15 years and older (3).

Diabetes can affect quality of life (QoL) not only by altering physiological processes (4). People with diabetes often experience difficulties with their disease in the long term and impact their physical and psychosocial (5-7). The lack of physical activity and psychosocial factors such

as health beliefs, social support, coping strategies and personality traits can reduce quality of life (5-7). This has been supported by several studies (5, 8-11).

Given the significant increase in the prevalence of diabetes and its impact on quality of life, effective management and control of this condition is critical (6). A primary goal of diabetes management is to improve the quality of life of people with diabetes. QoL is how people subjectively view themselves and their lives, whether good or bad, which can affect their health outcomes and is the ultimate goal of all health interventions (6, 8). Therefore, QoL is a fundamental aspect of the program and a key goal of health development (12). QoL can be expected in four domains including physical health, psychological health, social relationships and environment (8).

The quality of life of people with diabetes can be improved through certain interventions, including education and counseling programs designed to develop their ability to manage complications (6). The Diabetes Self-Management Education (DSME) program provides a sustainable framework to help people with diabetes lead a healthy lifestyle, and this activity has been shown to improve the quality of health of those who participate. Zheng et al. conducted research that demonstrated the effectiveness of the ambulatory DSME program in improving the level of self-management, psychological well-being, and glycemic control in patients with type 2 diabetes mellitus in China (13). Baraz et al. also conducted research demonstrating the positive impact of the DSME program on the quality of life of people with diabetes in India (12).

In addition to self-management, family support is essential in diabetes care. Family-based diabetes interventions involve communication between families and a plan to share the responsibility of caring for people with diabetes. Family-based interventions may improve the ability to prevent problems experienced by people with diabetes (14). Wichit et al. implemented a family-based self-management program that demonstrated a significant improvement in the quality of life of people with type 2 diabetes mellitus in Thailand (15). Similarly, Cai and Hu's study in Wuhan, China, showed an increase in the average quality of life related to physical and mental status of patients with type 2 diabetes after receiving a family-based intervention (16).

Therefore, it is essential to have knowledge about self-management for diabetic patients through diabetes self-management education interventions. In addition, to the best of our knowledge, there are still no specific programs that provide education to self or family of people with diabetes mellitus to support patient self-management in Indonesia, especially in Takalar Regency, South Sulawesi. The novelty of this study is to provide empirical evidence on these programs in the enhancement of diabetes management care.

The objectives of the study: (i) to investigate the effectiveness of DSME and family-based intervention; (ii) to compare the effectiveness between these interventions.

Materials and Methods

Location and research design

The study was conducted at the Aeng Towa Health Center in Takalar Regency using a quasi-experimental design with a one-group pre- and post-test (17). According to the Takalar District Health Profile 2017, it was reported that there were 2,446 cases of diabetes in Takalar Regency. Aeng Towa Health Center had 307 visits at that time, which increased to 459 cases in 2018 (18).

Population and sample

The study population consisted of patients with type 2 diabetes mellitus who had medical records and resided

in the working area of Aeng Towa Public Health Center in Takalar Regency. The investigators determined the sample size ($n_1=n_2$) by comparing the mean with the formula (19):

$$n1 = n2 = \frac{(\sigma_1^2 + \sigma_2^2)(Z_{1-\alpha/2} + Z_{1-\beta})^2}{\Delta^2}$$

n = number of samples

σ^2 = Variance

Z_α = Type I error (1.96, for 95% level of confidence)

Z_β = Type II error (1.64, for 95% level of confidence)

Δ = mean difference

For mean difference (Δ) and variance ($\sigma_1^2 + \sigma_2^2$), refer to previous similar research (12). Meanwhile, the study did not report the variance but the standard deviation (SD, σ) — standard deviation is the square root of the variance itself — therefore, SD can be used to replace the variance (20). The reference value for the mean difference and SD were 2.89 and 4.17, respectively (12). Thus, the total sample required for this research was 54 participants.

Procedures and instruments

The participants were non-randomly distributed to the DSME group (27 participants) and the family-based group (27 participants). Each group received the proposed intervention in four sessions over a period of 2 months (one week for each session with a one-week break between sessions). Intervention given during sessions, format and responsible for each group was presented in Table 1.

The participants received rewards after participation. The instruments used were questionnaires comprised of sociodemographic and WHOQOL-BREF. The standardized WHOQOL-BREF questionnaire in Indonesian version (<https://www.who.int/tools/whoqol/whoqol-bref/docs/default-source/publishing-policies/whoqol-bref/indonesian-whoqol-bref>) used to measure quality of life (QoL) included of 26 questions ($\alpha = 0.877$) with four main domains: physical health, psychological conditions, social relationships, and environmental conditions. The self-report questionnaire was completed before (pre-test) and after (post-test) the intervention for each group. All respondents participated in this study after signing a written informed consent.

Data analysis

The effectiveness of each intervention was defined by the increase in QoL after the intervention, with a significant means change between pre- and post-test. Meanwhile, the difference of effectiveness of both intervention was also examined with comparing the means value of pre- and post-test. Therefore, the study used two statistical test approaches: the independent and dependent

Table 1: Brief description of each session, format and responsible of DSME and Family-Based Interventions

Sessions	DSME	Format/Responsible	Family-based	Format/Responsible
Session 1	Eat health; physical activity	FGD/ healthcare professionals	Risk factors for diabetes; symptoms and complications	FGD/healthcare professional and family
Session 2	Blood glucose monitoring; medication	FGD/ healthcare professionals	Family values and support; identification of barriers	FGD/healthcare professional and family
Session 3	Problem solving, coping	FGD/ healthcare professionals	Relationship between physical activity, food, medication & diabetes control	FGD/healthcare professional and family
Session 4	Risk reducing	FGD/ healthcare professionals	Problem solving; healthy behaviors; goals setting	FGD/healthcare professional and family

DSME = Diabetes Self-Management Education; The participant’s family was involved in the family-based interventions; The role of health professionals was facilitator.

samples t-tests, after the normality assumption tested with Shapiro-Wilk ($p = 0.286$). The dependent t-test used to measure the effectiveness of each intervention (i.e., DSME and family-based intervention) and the independent t-test used to compare the effectiveness between these interventions. The reliability of the instrument was tested using Cronbach’s alpha (α). Statistical tests were two-sided with a 95% confidence interval (CI) with estimated error 5% ($\alpha = 0.05$). Statistical analysis was performed using STATA version 14 (StataCorp., College Station, TX: StataCorp).

Results

Table 2 shows the characteristics of the respondents. In the DSME intervention group, 44.44% of the respondents were aged 41-50 years, while in the family-based intervention group, 42.59% of the respondents were aged 51-60 years. Women were the majority in both groups, accounting for 66.67% of the DSME intervention group and 88.89% of the family-based intervention group. Both the DSME intervention group (85.19%) and the family-based intervention group (51.85%) were predominantly married. The majority of respondents in both groups had not completed primary school (44.44%). In terms of occupation, two groups of respondents were mostly housewives (59.26% and 85.19%, respectively). The majority were children who were responsible for caring for the patient, the majority were their children, accounting for 62.96% of the DSME group and 74.07% of the family-based intervention group.

Table 2: Distribution of general characteristic of respondent in Public Health Center Aeng Towa

Respondent Characteristic	DSME		Family-Based	
	n	%	n	%
Age				
41 – 50	12	44.4	9	38.9
51 – 60	11	40.7	12	42.6
61 – 70	4	14.8	6	18.5

Table 2: Distribution of general characteristic of respondent in Public Health Center Aeng Towa (continued)

Respondent Characteristic	DSME		Family-Based	
	n	%	n	%
Gender				
Man	9	33.3	3	11.1
Woman	18	66.7	24	88.9
Marital Status				
Married	23	85.2	14	51.9
Widow	4	14.8	13	48.1
Education				
Did not finish elementary school	12	44.4	12	44.4
Elementary school	8	29.6	9	33.3
Junior High school	4	14.8	3	11.1
Senior High school	2	7.4	2	7.4
Bachelor degree	1	3.7	1	3.7
Occupation				
Civil servant	1	3.7	0	0.0
Entrepreneur	6	22.2	2	7.4
Fisherman	2	7.4	1	3.7
Housewife	16	59.3	23	85.2
Retired	-	0.0	1	3.7
Have no job	2	7.4	0	0.0
Relatives				
Husband/Wife	9	33.3	5	18.5
Child	17	63.0	20	74.1
Grand child	1	3.7	2	7.4
Total	27	100	27	100

DSME = Diabetes Self-Management Education

The mean QoL score for the physical health domain in the DSME group before and after the intervention was significant ($p = 0.004$). There was no significant difference in the mean physical health score in the family-based group before and after the intervention ($p=0.453$). The mean scores of QoL for the psychological domain in the DSME and family-based groups showed a significant difference before and after the intervention ($p = 0.018$ and $p = 0.010$, respectively). The DSME group showed a significant

difference in the mean QoL score for the social relationship domain before and after the intervention ($p < 0.001$), while the family-based group did not show a significant difference ($p = 0.546$). The DSME group also showed a significant improvement in mean QoL in the environmental domain before and after the intervention ($p = 0.047$). Similarly, the family-based group also showed a difference in mean scores before and after the intervention ($p = 0.029$). The mean QoL score in the DSME group increased by 4.97, which was statistically significant ($p = 0.003$). Similarly, the group that received the family-based intervention also showed an increase in mean score of 3.89, which was also significant ($p = 0.045$, Table 3).

Table 3: The difference of mean score on life quality before and after Diabetes Self-Management Education Intervention and Family-Based Diabetes Intervention in Public Health Center Aeng Towa

QoL	DSME		Family-Based	
	Mean ± SD	p value	Mean ± SD	p value
Physical Health				
Pre test	22.3 ± 3.4	0.004	22.3 ± 3.9	0.453
Post test	23.7 ± 3.0		22.7 ± 3.7	
Psychological condition				
Pre test	18.6 ± 2.9	0.018	18.1 ± 3.4	0.010
Post test	19.9 ± 2.6		19.6 ± 3.4	
Social Relation				
Pre test	9.1 ± 1.9	<0.001	10.0 ± 1.6	0.546
Post test	10.2 ± 1.8		10.2 ± 2.1	
Environmental Condition				
Pre test	26.0 ± 2.9	0.047	24.7 ± 3.8	0.029
Post test	27.3 ± 4.0		26.4 ± 3.2	
Life Quality/ QoL				
Pre test	76.0 ± 9.9	0.003	75.1 ± 10.2	0.045
Post test	81.0 ± 10.4		79.0 ± 9.9	

DSME = Diabetes Self-Management Education
QoL = Quality of Life

Table 4 shows that there was no significant difference in the mean scores of physical domains of QoL before and after the intervention between the DSME intervention group and the family-based intervention group ($p_{pre} = 1.000$ and $p_{post} = 0.297$). For psychological ($p_{pre} = 0.577$ and $p_{post} = 0.789$), social relationship ($p_{pre} = 0.081$ and $p_{post} = 0.944$), and environmental ($p_{pre} = 0.157$ and $p_{post} = 0.372$) domains, there was no significant difference between the DSME intervention group and the family-based intervention group before and after the intervention. Meanwhile,

there was no significant difference between the DSME intervention group and the family-based intervention group in the mean of the overall quality of life score before the intervention ($p_{pre} = 0.727$ and $p_{post} = 0.466$).

Table 4: The difference of Mean score on Life Quality between Diabestes Self-Management Education Intervention group and Family-Based Diabetes Intervention Before and After intervention in Public Health Center Aeng Towa

QoL	Pre-test		Post-test	
	Mean ± SD	p value	Mean ± SD	p value
Physical Health				
DSME	22.3 ± 3.4	1.000	23.7 ± 3.0	0.297
Family-Based	22.3 ± 3.9		22.7 ± 3.7	
Psychological Condition				
DSME	18.6 ± 2.9	0.577	19.9 ± 2.6	0.789
Family-Based	18.1 ± 3.4		19.6 ± 3.4	
Social Relation				
DSME	9.1 ± 1.9	0.081	10.2 ± 1.8	0.944
Family-Based	10.0 ± 1.6		10.2 ± 2.1	
Environmental Condition				
DSME	26.0 ± 2.9	0.157	27.3 ± 4.0	0.372
Family-Based	24.7 ± 3.8		26.4 ± 3.2	
Life Quality/ QoL				
DSME	76.0 ± 9.9	0.727	81.0 ± 10.4	0.466
Family-Based	75.1 ± 10.2		79.0 ± 9.9	

DSME = Diabetes Self-Management Education
QoL = Quality of Life

Discussion

This study found an association between diabetes self-management education (DSME) interventions and improved QoL in people with type 2 diabetes mellitus (DM). DSME is a program designed to provide patients with the knowledge and skills necessary to self-manage their diabetes. This includes managing their diet, physical activity, blood glucose monitoring, medication management, problem solving, healthy coping, and reducing the risks and complications associated with the disease (21). This study is consistent with Azami et al. who showed a significant improvement in the QoL of diabetic patients who received DSME intervention for six months. DSME is provided to patients in the form of discharge planning to increase their knowledge about diabetes mellitus and improve their self-care skills (22).

After receiving the DSME intervention, people with DM experience a significant improvement in their physical health. This is consistent with Baraz et al. (12) who found an improvement in the physical function and role of diabetic patients who received the DSME program. The program educates and encourages patients to address key risk factors, including lifestyle, diet, and increased physical activity (13).

The psychological state of people with diabetes can significantly affect their QoL. Emotional disturbances, such as anxiety and fear of ongoing treatment, can reduce their overall well-being. According to this study, there is an association between the DSME intervention and the psychological condition of people with DM. Zheng et al. found that patients who received the DSME program for three months experienced statistically significant improvements in their psychological conditions (13). However, Baraz et al. reported that the emotional role and overall mental perception of patients did not change significantly after receiving the DSME program, indicating the need for a deeper psychological approach to diabetes management (12).

In the area of social relationships, it is evident that there is an association between the DSME intervention and the social relationships of people with DM. The study found that people with diabetes who received the DSME program showed a statistically significant improvement in their social functioning. In addition, the study showed positive results in the area of environmental quality of life after patients received the DSME intervention for people with DM. This is consistent with research showing an increase in the average score for the group receiving home care services. Patients' perceptions of financial ability, freedom, availability of health and social services, home environment, physical environment, and transportation also changed with education and management of their disease conditions (22).

In addition, this study also demonstrated an association between family-based diabetes interventions and improved QoL for people with type 2 DM. The family-based intervention program emphasizes the impact of family involvement on all aspects of the patient's quality of life. This ongoing support requires family members or relatives to assist with diabetes self-management behaviors that can be integrated into daily life. The patient received critical support from family members during each session, especially those living in the same household, with the goal of improving patient care (15, 16).

QoL scores and domains increased, although only the psychological and environmental domains and overall quality of life were statistically significant. The emotional and psychological state of family members can affect the well-being of people with diabetes. In this study, patients reported feeling supported and empowered to manage their disease when accompanied by family members. This finding is consistent with the research of Cai and Hu, who found a statistically significant increase in QoL

related to mental health and psychological well-being (16). In addition, this study demonstrates an association between family-based interventions and improved environmental conditions for individuals with diabetes mellitus. This finding is consistent with previous research on motivational interviewing and exercise interventions, which have been shown to be effective in improving social and environmental QoL in people with type 2 DM (23). Wichit et al. also demonstrated a significant improvement in QoL in individuals with type 2 diabetes mellitus in Thailand following the family-based intervention program. In addition, this program was successful in increasing independence and self-care behaviors, which are important in reducing diabetes-related complications (15).

Finally, there was no difference in the QoL score and its domains between the two intervention groups. This is because both the DSME intervention and the family-based diabetes intervention can improve the QoL of people with type 2 DM through practical education on self and family care and support (21, 22). The purpose of this education is to increase self-care knowledge and skills so that patients can avoid further complications. This is implemented through interventions such as DSME, which is an effective form of education for people with diabetes. Family-based interventions have also been shown to improve the quality of life of patients with type 2 diabetes by increasing their adaptive and cognitive abilities to manage the disease with the support of their families (22, 24-26).

This study has several limitations. These include small sample size and the possibility of bias in the use of self-reported measures. The limitations may also come from the study design, which has the potential for selection bias due to lack of randomization and may fall in making casual claims. Since there is no control for each intervention in this study, it may also limit the research confidence. However, these findings may suggest clinical or public health implications for the management of DM patients in the context of improving their quality of health. Since this program has not yet been implemented in any health center in South Sulawesi, Indonesia; therefore, these interventions would be very helpful. This study suggests for future research need to be carried out by involving more sample size, adequate study design with control, and may modify the intervention duration to get better results. Furthermore, combination of both interventions may also be interesting to study the effectiveness.

Conclusion

The Diabetes Self-Management Education intervention program has been shown to improve overall QoL and all domains of physical health, psychological well-being, social relationships, and environmental conditions in people with diabetes. Family-based diabetes interventions also improved patients' QoL and the domains of patients' psychological state and environmental conditions. There was no difference in QoL outcomes between the two intervention groups, as both managed to improve the QoL

of people with type 2 diabetes mellitus. Education and proper self-care patterns are expected to help diabetic patients solve the problems they face and improve their QoL.

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None

Competing interests

The authors declare that they have no competing interests.

Ethical Clearance

Ethical approval was obtained from the Ethics Committee of the Faculty of Public Health, Hasanuddin University (approval number: 942/UN4.14.1/TP.02.02/2021).

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References

1. IDF. Advocacy Guide to The IDF Diabetes Atlas Ninth Edition. International Diabetes Federation. 2019. Available at: <http://www.idf.org/about-diabetes/facts-figures>. Accessed 01 January 2023.
2. WHO. Global Report on Diabetes. Switzerland: World Health Organization. 2016. Available at: <https://www.who.int/publications/i/item/9789241565257>. Accessed 01 January 2023.
3. Indonesian Ministry of Health. Main Results of Basic Health Research (Riskesdas). 2018. Available at: <https://www.litbang.kemkes.go.id/laporan-riiset-kesehatan-dasar-riskesdas/>. Accessed 01 January 2023.
4. Gard P, Duggal N. Type 2 diabetes mellitus, its impact on quality of life and how the disease can be managed-a review. *Obes Med*. 2022; 35:100459.
5. Amiruddin R, Arsunan A, Wahyu A, Awal M, Sumantri E & Annah I. Exercise, Stress, Cholesterol, and Hypertension as Risk Factors of Type 2 Diabetes Mellitus in South Sulawesi, Indonesia. *Indian J Public Health Res Dev*. 2019; 10(8):1486-91.
6. Rubin RR, Peyrot M. Quality of life and diabetes. *Diabetes/metabolism research and reviews*. 1999; 15(3):205-18.
7. Liu X. Advances in Psychological and Social Aetiology of Patients with Diabetes. *Diabetes Metab Syndr Obes*. 2023; 16:4187-94.
8. Manjunath K, Christopher P, Gopichandran V, Rakesh PS, George K, Prasad JH. Quality of life of a patient with type 2 diabetes: a cross-sectional study in rural South India. *J Family Med Prim Care*. 2014; 3(4):396-9.
9. Chida Y, Hamer M. An association of adverse psychosocial factors with diabetes mellitus: a meta-analytic review of longitudinal cohort studies. *Diabetologia*. 2008; 51:2168-78.
10. Degu H, Wondimagegnehu A, Yifru YM, Belachew A. Is health related quality of life influenced by diabetic neuropathic pain among type II diabetes mellitus patients in Ethiopia? *PLoS ONE*. 2019; 14(2):e0211449.
11. Aschalew AY, Yitayal M, Minyihun A. Health-related quality of life and associated factors among patients with diabetes mellitus at the University of Gondar referral hospital. *Health Qual Life Outcomes*. 2020; 18(62):1-8.
12. Baraz S, Zarea K, Shahbazian HB. Impact of the self-care education program on quality of life in patients with type II diabetes. *Diabetes Metab Syndr*. 2017; 11:S1065-68.
13. Zheng F, Liu S, Liu Y, Deng L. Effects of an Outpatient Diabetes Self-Management Education on Patients with Type 2 Diabetes in China: A Randomized Controlled Trial. *J Diabetes Res*. 2019; 2019:1073131.
14. Vaala SE, Hood KK, Laffel L, Kumah-Crystal YA, Lybarger CK, Mulvaney SA. Use of commonly available technologies for diabetes information and self-management among adolescents with type 1 diabetes and their parents: a web-based survey study. *Interact J Med Res*. 2015; 4(4):e24.
15. Wichit N, Mnatzaganian G, Courtney M, Schulz P, Johnson M. Randomized controlled trial of a family-oriented self-management program to improve self-efficacy, glycemic control and quality of life among Thai individuals with Type 2 diabetes. *Diabetes Res Clin Pract*. 2017; 123:37-48.
16. Cai C, Hu J. Effectiveness of a Family-based Diabetes Self-management Educational Intervention for Chinese Adults with Type 2 Diabetes in Wuhan, China. *Diabetes Educ*. 2016; 42(6):697-711.
17. Murti B. Principles and Methods of Epidemiological Research. Central Java: Eleven March University. 2018.
18. Takalar Health Office. Takalar District Health Profile 2019. Available at: <https://sirusa.bps.go.id/sirusa/index.php/sektoral/view?kd=8943&th=2019>. Accessed 01 January 2023.
19. Rosner B. Fundamentals of Biostatistics 7th Edition. Boston: Brooks/Cole, Cengage Learning. 2010.
20. Dahlan MS. Besar Sampel dan Cara Pengambilan Sampel dalam Penelitian Kesehatan (Edisi Revisi). Jakarta: PT. Rineka Cipta. 2013.
21. Hailu FB, Moen A, Hjortdahl P. Diabetes Self-Management Education (DSME) - Effect on Knowledge, Self-Care Behavior, and Self-Efficacy Among Type 2 Diabetes Patients in Ethiopia: A Controlled Clinical Trial. *Diabetes Metab Syndr Obes*. 2019; 12:2489-99.
22. Azami G, Soh KL, Sazlina SG, Salmiah MS, Aazami S, Mozafari M, & Taghinejad H. Effect of a Nurse-Led Diabetes Self-Management Education Program on Glycosylated Hemoglobin among Adults with Type 2 Diabetes. *J Diabetes Res*. 2018; 2018:4930157.
23. Limbong UB, Amiruddin R, Thaha RM. The Effect of Motivational Interviewing and Gymnastics on

- the Quality of Life of Type 2 DM Patients at the Pattingaloang Health Center. *Mulawarman J Pub Health*. 2018; 1(3):352-58.
24. Buchair NH, Amiruddin R, Indar I. Pengaruh Konseling Home care Terhadap Kualitas Hidup Penderita DM Tipe 2 Di Puskesmas Talise Kota Palu. *J Public Health*. 2021; 12(2):332-43.
 25. Hu J, Amirehsani KA, Wallace DC, McCoy TP, Silva Z. A Family-Based, Culturally Tailored Diabetes Intervention for Hispanics and Their Family Members. *Diabetes Educ*. 2016; 42(3): 299-314.
 26. Syatriani S, Amiruddin R, Nurhaedar, Ansariadi. Assessment of the Family Support on the Improvement of Health-Related Quality of Life for Alcoholics and Smokers in Type 2 DM Patients in Makassar Municipality. *Int J Science*. 2017; 32(2):270-81.