Developing Pictographs for Increasing Adherence in Patients with Diabetes Mellitus

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Abstract Introduction: The compliance of low literate and illiterate patients might be improved and disease complications prevented by using pictographs. This study was carried out using qualitative methods to design pictographs for increasing adherence in low literate and illiterate patients with diabetes mellitus. Material and methods: An action research was carried out after facing compliance problems in illiterate diabetic patients. A professional graphic designer designed pictographs under the supervision of health education, endocrinology and nutrition specialists, in two cycles and after conducting interviews with 23 low literate and illiterate patients. The data was analyzed by qualitative methods. Results: After a long and durable process and 23 interviews [with 16 illiterate and 7 low literacy persons[and 2 cycles, 10 pictographs for correct medicine consumption, 8 for foot care, 4 for diet, 113 for food substitutes and 1 for physical exercises were created, which were acceptable and understandable for most patients. Conclusion: Pictographs might be helpful for increasing adherence in illiterate or low literate patients who have problems with written instructions. In the present study we designed some pictographs to help these patients. It is necessary to carry out studies to prove the efficacy of these pictographs in improving patient adherence through quantitative methods.

Keywords: pictographs, low literate, illiterate, diabetes mellitus, adherence

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1. Introduction

Diabetes mellitus is an increasing health problem and has led to many deaths throughout the world. This disease has to be timely diagnosed and treated in order to prevent its debilitating side effects [1,2]. According to the estimate of the World Health Organization in 2010 more than 285 million people were suffering from diabetes mellitus which led to 4 million deaths. Based on predictions, the number of diabetes sufferers will soar to 438 million in 2030 [3].

In other words, until 2025 about 75% of the diabetes patients will be in the developing countries. Also, younger ages and significantly young adults and even adolescents will not be safe from type II diabetes [4]. Oldness, growth of population, increasing trend of obesity, unhealthy nutrition, and static life style are the reasons of the worldwide increase of this disease [4,5].

Diabetes mellitus is one of the most popular metabolic diseases and patients have to visit family and general physicians regularly [6].

Due to the increase of the cost of health care and elderliness of the diabetes patients, the economical load on the society is increasing so that half of the patients older than 65 years old are hospitalized every year [7]. Generally, the probability of death from diabetics is about twice in comparison with other people. A decline in life expectancy is seen among women suffering from diabetes and specially those who have experienced diabetes complications. Therefore, it is necessary to standardize the activities for control and cure of diabetes patients [8].

Diabetes mellitus treatment is a complicated task including changing life style in order to optimize nutrition and physical activities along with medical treatment for compensation of the lack of insulin or insulin resistance. Acceptance of physician recommendations leads to the control of diabetes and a decline of HbAlc which results in less complications and a decrease of diabetes costs [9].

Management and treatment of diabetes depends on the cooperation of patients and their compliance. Education and training plays an important role in the management and treatment of diabetes. Patients can manage and control their disease with the help of some self-care activities like eating food based on a special program, regularly testing their blood glucose, and doing some exercises [10]. Failure in care or treatment of the patient leads to increased diabetes complications. But with the help of suitable self-care treatments the probability of cardiovascular complications, which is the cause of death in 70 to 80 % of diabetes patients, decreases [11].

According to the studies, diabetes patients who are low literate or illiterate need more attention. Some suitable training programs are necessary to make them capable of self-care and compliance with physician orders [12,13]. Unfortunately, patients forget a lot of things the physicians tell them. According to the studies, only 29 to 72% of the patients remember physician sayings. Also, the more the information are, the less the patients remember [14].

Although there are many medical instructions for helping the patients at home, they are not helpful for millions of low literate and illiterate people. Most of the time low literate and illiterate people are puzzled and disappointed by the instructions and cannot use them. The need for the exchange of health information to low literate and illiterate people has increased, recently. Most of these efforts are to simplify training language, and/or add pictographs in order to make the information clear and understandable [14]. Pictographs can also help low literate and illiterate people remember dietary or medical orders.

Based on Mayer's theory of CTML "Cognitive Theory of Multimedia Learning", people have the ability of processing and understanding written and visual information. When people receive suitable information, they manage it in their mind and relate the main structures, and therefore learning happens. This kind of learning is more a deep understanding, than a simple learning. Pictures act as guidance and lead to memorizing information, even when those people see the same pictures later [15].

In addition to medical treatments, diabetes needs attention and care of the patients themselves. In order to control and treat diabetes, patients need a lot of information. Many of these patients do not have the ability of using the existing instructions because of being low literate or illiterate. These people also have low level self-care treatments which lead to irrecoverable complications and finally death because of diabetes complications. Many of these patients are old people who live alone or with their wife/husband. Therefore, a special training method for these people is necessary. It is possible to increase the capability of the low literate and illiterate patients with the help of some simple pictographs and therefore prevent an early death due to the complications of diabetes. This study is an effort on the way of achieving this goal.

According to our knowledge, using pictographs for educating diabetic patients has not been done before and similar studies were not found after searching different databases.

2. Methods

This study was an action research study performed in Kerman Province, Iran. This study was designed based on a previous study conducted by the researchers [13] that showed illiterate diabetic patients have less compliance than other patients. Most of the trouble in this group was related to the fact that they could not read written instructions or could not use written memos for taking their drugs on time. Therefore, these patients were very interested to use pictographs and thought that these graphs will help them overcome their compliance problems related to illiteracy.

"Action research is a disciplined process of inquiry conducted by and for those taking the action. The primary reason for engaging in action research is to assist the actor in improving and/or refining his or her actions." [16] The inquiry in this study was what type of pictographs might help illiterate diabetic patients comply with their diet and therapy?

An action research is a research strategy based on the fact that research is not an effort made far from the people. Denzin & Lincoln (1994) believe that increasing attention to the limitations of conventional qualitative and quantitative research leads to more growth of action research which emphasize on locally and temporal cases. Simmouns (1995) believes that action research belongs to the new paradigm, research via cooperation, and is interested in research with the people not just about the people [17].

In this study, participants were low literacy (less than 6 years school education) or illiterate diabetic patients who were willing to participate. Patients were found at the office of an endocrinologist and from health centers in rural Kerman. Patients with Alzheimer's disease and those with severe vision or articulation problems were excluded. Sampling was continued until data saturation. All participants were female. The other characteristics of the participants have been mentioned in Table 1.

Table 1. The characteristics of the participants in this study.

Age	35-78 years
Duration of the disease	1-15 years
Literacy	Low literate = 7 people Illiterate = 16 people

Action research includes 6 steps. Step 1: Selecting a focus. Step 2: Clarifying theories. Step 3: Identifying research questions. Step 4: Collecting data. Step 5: Analyzing data. Step 6: Reporting results. Step 7: Taking informed action [16].

In this study a focus was selected that was about how to improve compliance in illiterate diabetic patients (step 1). Then a theory was developed based on patient and physician comments that using pictographs might be helpful (step 2). The initial pictographs were made based on the endocrinologist's and the dietitian's comments. Some questions were framed to see if the patients understand the meaning of the pictographs. Also the researcher encouraged the participants to comment on how to improve in pictographs (step 3). The participant comments were recorded and transcribed (step 4). The data was read several times in order to extract the main finding that could help the researcher further tailor and improve the pictographs (step 5). The results were condensed and were argued upon with the endocrinologist, nutritionist, epidemiologist and sociologist and plans were make for correcting the pictographs (step 6). The graphic

designer changed the photos and the new photos were used for teaching a new group of patients. Then the steps were repeated from 3 to 7.

In this study, first the information in four fields were gathered including 1) how to use medicine 2) proper diet (four diets for normal, slim, overweight people, and obese) 3) physical activities 4) foot care. Then, these instructions were prioritized in the consulting sessions with diet and endocrine specialists.

The prioritized information and the idea of how to design the pictographs were given to a graphic designer to design the pictographs in the aforementioned cases. Then, an expert panel, corrected and reviewed the graphs and the pictographs. After confirmation of the reviewed pictographs by the specialist, pictographs were evaluated with the help of group and individual discussions, low literate and illiterate diabetes patients (those who have trouble with using written instructions).

In the interview the researcher first asked if the participant could guess the meaning and the purpose of the pictograph. Then she would tell the participant the intended meaning of the pictograph and ask the participant, if she could provide comments about how to change the pictograph in order to be more understandable for the patients.

The interviews were conducted by the first author and a research assistant. Both were familiar with the native dialect. Each interview lasted for 45 minutes to one hour and was conducted in a quiet room close to the endocrinologist's office or the rural health center at a time suitable for the patient.

The first step was saturated with individual interviews with 9 people. The interview sessions were taped completely and transcribed accordingly, and at each step the results were analyzed qualitatively. The information obtained from the discussion and interview sessions were used for corrections. After the confirmation of the pictographs by specialties and holding an expert panel and some corrections, pictographs were evaluated in a population of low literate and illiterate diabetes patients again.

In the second step, 16 patients were invited for interview, but only 14 people cooperated in the interviews. Although the study was explained thoroughly for the participants and they agreed to participate in the study; 2 of them did not make any comment about improving the photos and withdrew because of time restrains.

In this study comments were categorized according to each picture and its purpose, and were used in order to change or improve the pictographs.

All of the final pictographs were acceptable by all participants and no further suggestion was received for the improvement of the pictures. Therefore researchers felt that there was no need for further correction of the pictographs. Therefore, the final pictographs were retained.

In order to prove the rigor of this action research study, the four trustworthiness criteria recommended by Lincoln and Guba were used [18].

For evaluating credibility prolonged engagement and member checking procedures were used. In the prolonged engagement method, constant observation and evaluation and also good communication manners of the researcher enhanced understanding the viewpoints of the participants and provided data with good quality. In this study the researcher and an assistant conducted and evaluated all interviews. They were acquainted with people's culture and dialect and were able to communicate with the participants well.

In the member checking procedures, the accuracy of the data recorded was revisited by other researchers to see if the results were valid. In this study the results and interpretations were also checked by the supervisors and co-supervisors of the study.

Dependability is defined as establishing the stability and reliability of the data in the similar time and conditions through clarifying an audit trail.

Confirm ability was achieved when the reports and field notes were given to another researcher and both extracted the same results. In this study to achieve confirm ability, the data and the extracted report was also reviewed by the supervisor and co-supervisor of the study.

In order to prove transferability the final pictographs were shown to patients outside the study population to see if it is understandable for them or not. And they were able to explain the meaning of the pictographs. In this study in addition to the city of Kerman, participants were also recruited from nearby villages.

Also the researchers intended to achieve critical validity (Streubert, 2007) through close understanding of the context and the people involved. The researchers and the interviewers were native and acquainted with the culture of the people living in Kerman province.

3. Results

At the end of this study after a long term and durable process and interview with 23 people 10 pictographs for correct use of medicine, 8 pictographs for foot care, 4 pictographs for food diet, 113 pictographs for food substitutes, and 1 pictograph for physical activities were made which were acceptable for most of the patients.

Most of the pictographs for medicines were in three following groups: 1) eating food before or after medicine 2) medicine use (tablet or insulin) 3) sleeping or awaking for showing the time for the use of medicine. At the first step, in order to show the time of using tablets, a standing dummy (full length) was designed. After an interview with the patients, most of them did not realize the dummy using the tablet.

One participant commented: " *I think … (after a few seconds silence and thinking)his hand is high up, as if he wants to do exercise, his hand has to be lower and close to his mouth, then I will understand that he wants to eat his pill.*"

Therefore, some corrections were considered for better understanding of the patients. Thus, the lower half of the body was eliminated, and the head and hand of the dummy were designed to be towards down and the tablet was designed 3-dimensional and big, and a package of the tablets was designed beside the dummy. Also, since the people of that region were unfamiliar with tables and chairs, table linen instead of table and chair and bed (mattress and coverlet) instead of bedstead were designed (Figure 1).
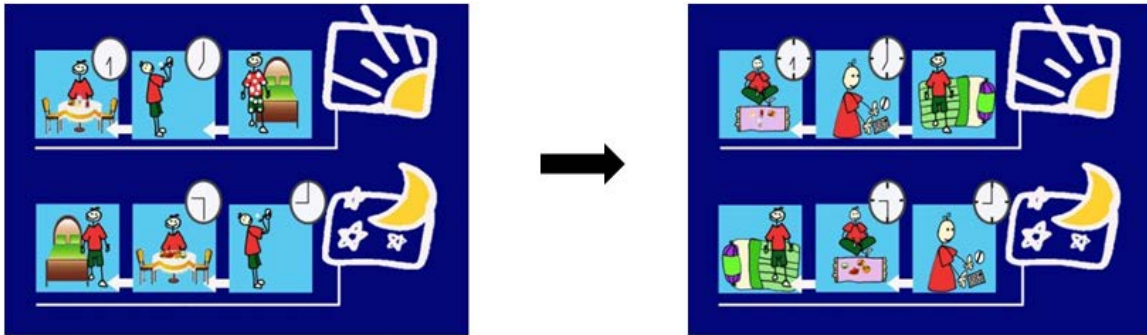
Figure 1. Pictograph of the use of pills by dummy. Left picture: before interview with the patients, right picture: after interview with patients

Most of the people who participated could not realize the physician prescription for the use of Acarives tablet. This tablet has to be used after the first mouthful. So, in all the three parts, the dummy was designed eating food. In the second part, a spoon in one hand and a tablet in the other hand of the dummy were designed (Figure 2).
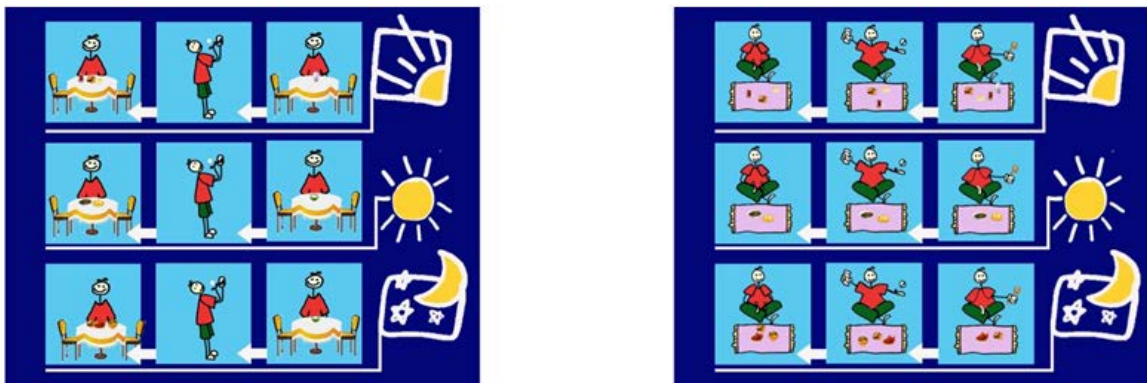

Figure 2. Acarives tablet which has to be used after the first mouthful. (Left: the first picture, Right: picture corrected after patient interviews)

In the pictographs related to diet, in order to show the permitted amount of bread, a round-shaped piece of bread (Taftoon type) was designed and for different people (slim, normal, overweight, obese). A line on the round-shaped bread showed the permitted portion. But, a number of participants could not recognize the bread. Therefore, the other shape (and kind) of bread (Barbari) was designed and the permitted portion was considered as a piece [slice] of the bread out of the full shape of it. Also, according to participant comments, the decorations around the kebab were eliminated for the overweight and obese people, and Swiss cheese was replaced by white cheese. In addition, most of the people suggested that it was good to use a chicken leg instead of a full chicken in the food suggestions related to the dinner of diabetes patients.

In the snack (between two meals), in the first step, biscuits were designed to be round. However, most of the people under study could not realize the shape of the biscuit. Therefore, another shape of the biscuit (rectangular) was designed.

In this study, the amount of required primary food and components for the existing food were designed under every diet. But, most of the people could not realize the meaning of the food units under the pictures. However, after some explanations by the interviewers the people understood the explanations for the diets and no further comments were made. (Figure 3)
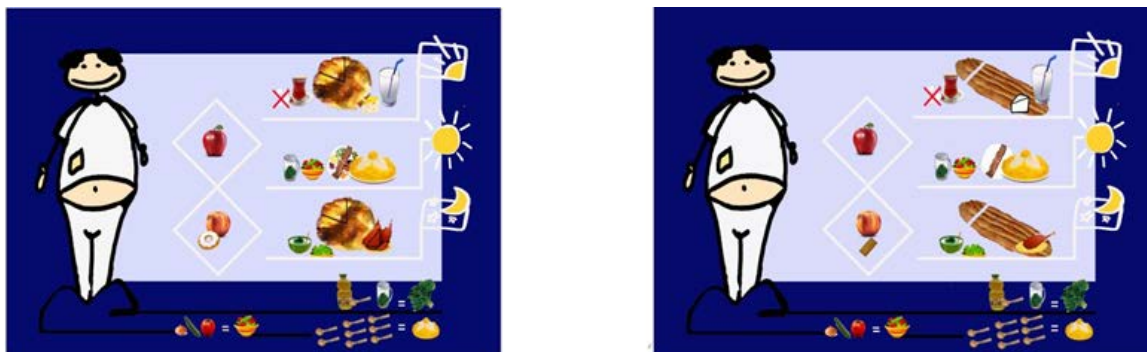

Figure 3. A pictograph showing a sample diet (Left: initial pictograph. Right: pictograph after corrections)

Pictographs about footcare were designed in 8 graphs. These graphs were changed according to the interviews. In the first pictograph that was about daily foot washing, patients did not understand the meaning. Therefore the pictograph changed completely and a dummy was designed washing his feet with tap water. In the other

pictograph which showed daily foot massage with moisturizing creams, because the back screen was white patients did not notice the cream, therefore in the next pictographs the back screen was darkened and in the next round of interviews the cream was recognized by the participants.

The next physician recommendation was daily observing their feet, so that if they noticed an ulcer they should see a physician. However the ulcer in the pictograph was not clear for the patients. Therefore, real photos were used instead and in the next round of interviews patients understood the meaning of the pictographs.

One participant commented: "I think the picture has to be real. You have to show a real human with real blisters and ulcers, like the real pictures we see in clinics about AIDS, diabetics or heart disease, … with real photos we understand much better."

In another pictograph the proper way of nail clipping in diabetics was shown. Interviewers noticed that the additional drawings in the pictographs had led to a lot of distraction. Therefore in the corrected pictographs all the extra drawings were deleted.

Choosing the right type of shoe was also displayed in another pictograph. The proper shoe for use in diabetics was shown and improper shoes were also displayed with a red cross. Patients understood the meaning of the pictographs.

In another pictograph the proper way of warming the feet with a blanket or quilt was shown and the incorrect way (using a heater) was shown with a red cross (Figure 4).
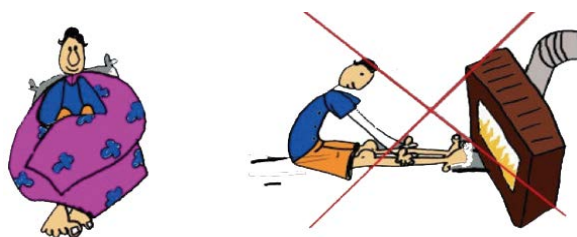

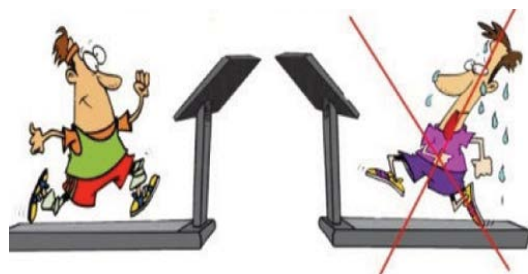**Figure 4.** Use of blanket for warming feet and not using heater

Figure 5. A diabetes patient can exercise until he sweats and becomes out of breath

Some pictographs were designed related to physical activities and sports that diabetes patients can do. But, as a result of the lack of facilities in Kerman Province some of the sports like skiing were eliminated and exercising (morning exercises) was added to the picture. In order to show the intensity of the exercise for the diabetes sufferers a pictograph was designed in which a dummy running on treadmill was easily speaking without being out of breath. But, most of the participants could not realize the meaning of the pictograph, and therefore in the second step a pictograph was design in which a dummy with a red face

and the tongue being out of the mouth while his hand being on his chess was designed, and at the other side a dummy that easily exercised was designed (Figure 5).

Based on the necessity, it was decided to make a comment at the beginning of the booklet of pictographs for the physician or food consultant asking them to review all the pictures for the patients once to make them aware of their meanings. Also, it was decided to make a comment under every picture about the meaning of it. Therefore, in case patients forget the meaning of the picture they can ask the literate people in the family to help them remember the meaning.

4. Discussion and Conclusion

Health trainers use different methods to train the low literate and illiterate people. Most of these people are old and suffer from chronic diseases like diabetes, blood pressure, heart and veins disease etc. These diseases need long, complex and step-by-step instructions. Pictures, animations, video clips and pictographs are among the tools used for training such people. Each of these tools has some pros and cons. These days, pictographs are the best strategy for training low literate and illiterate people in order to empower them for self-care. Pictographs are simple drawings designed to train the main objectives and are free from details which lead to distraction. In addition, pictographs can be designed for people with different cultures, different ages, and different languages. This point leads to improvement in training [19].

As mentioned, the goal of this study was to achieve some pictographs to empower low literate and illiterate diabetes patients to control their blood glucose and prevent early deaths because of the complications of diabetes. Low literate and illiterate diabetes patients have a low capability of self-care which can lead to irrecoverable complications.

Therefore, some methods to increase the adherence of these people are necessary. In this study some pictographs have been designed which are expected to be helpful for solving this problem in low literate and illiterate people.

In this study, after designing the first version of the pictographs of medical instructions [using medicine, food, diet, physical activities, danger signs and appropriate actions] and holding an expert panel and correcting the pictographs in several steps, the pictographs were investigated again in a population of low literate and illiterate people. The patients mentioned some important, delicate, and worth thinking points which were very helpful in understanding the true meaning of the pictographs. It shows that in the design of the pictographs it is necessary to use the goal population who are supposed to use the pictographs. Chuany et al (2010) in their study of comparison between low literate patients and medical employees in the level of understanding and realizing the pictographs designed for medical instructions for outpatients in clinics mentioned that for a good design of pictographs understandable for prescriptions; it is necessary to consult with the patients to be sure that the designed pictographs are useful for all the people especially low literate ones [20].

Cooperation with others has some benefits like building trust, empowerment of the cooperators, and reduction of

the number of services and programs, building responsibility, and strengthening the relations. In health training, in order to have a good health program a suitable assessment is necessary. Inviting others in doing assessment is very important and can control the load of work. The cooperation of the people and organizations that are probable to be affected by the program, can improve the assessment, program implementation, program acceptance, and the program itself [21].

In the course of conducting interview with low literate and illiterate people, when the understanding of the pictographs was difficult, the pictographs were read by the researcher for once. After reading the pictographs, the people were asked to explain the medical instructions. The people were able to explain the pictographs well, and they did not need any further explanations. This shows that in most cases the pictographs cannot work independently, and it is needed to be explained by the physician or nurse for the patient at least one time. Fortunately, this is possible and increases the understanding and adherence of the patients about the medical instructions.

In this study, since the goal population was both low literate and illiterate people in the society, it was tried not to use any other title in the pictographs except for food material substitutes. On the other hand, in health training, in the design of posters and other vision media it is emphasized to use the least possible words (Ahadian, 2001). In this study, this fact was followed and good results were obtained and nobody asked for considering some titles for the pictographs. But, this is against the results obtained by Choi (2011). He mentioned that pictographs without title may convey some different meanings and be puzzling for the people especially low literate ones.If the pictographs were added to the training texts, they can be very good guidance for the people. However, low literate people may not pay attention to the texts at all and try to understand the meaning of the pictographs by looking at them from the beginning. In addition, reminding the texts with and without the pictures is better for the young people. But, for the old low literate people the use of pictures is recommended [19]. Houts et al (2006) mentioned this point and stated that for showing the activities related to health which have some steps, it is recommended to use simple pictures with titles to convey the meaning to the patients [23].

The impact of different cultures in the design of the pictographs was an important point in this study, so that in the first step in order to show breakfast, lunch, and dinner with the pictures, tables and chairs were used, and also bedstead was used as a pictograph of sleeping. However, after interview with low literate and illiterate people, it was found out that according to the customs of the people of the region, it was better to use table linen and bed (mattress and coverlet) in the pictures.

Also, Choi (2012) in a similar study, paid attention to the design of pictographs for instructions related to the care of breasts for the immigrant women who were not good at English. In the results part, he mentioned that using red crosses lead to fear and stress (Choi 2012). But, in our study, some of the participants recommended using red crosses, and no feeling of fear or stress was reported.

Therefore, paying attention to the differences between the cultures of the people in different regions is a very important factor in the design of the pictographs. Different models in health training like PEN3 model emphasize on the importance of considering culture impact in training [21].

Use of pictographs in training is a suitable strategy for the empowerment of the low literate and illiterate people. In this study it was found out that old people who visit the diabetes centers and cost more to the system because of lack of capability in the control of their blood glucose, can understand many of the medical instructions with the help of some simple pictographs. So, it would be possible to help these people even more with the help of more special pictographs designed by using high technology. All the 23 patients who cooperated in this study considered this research as a very important need and they all were interested in cooperation.

At the end, it is recommended to use and test these pictographs at different corners of Iran and according to the cultures of the regions suitable changes can be made.

In addition, according to the large number of patients who visit endocrinologists, it is recommended to consider some places in diabetes centers for training the patients with the help of pictographs [19,23].

Although the final pictographs were approved by the patients and eventually none of the patients were able to provide any further comments for improving the pictographs, still the researchers feel that the internist or dietician should explain the meaning of the pictographs during the first introduction and in a consulting session to clarify any ambiguities.

A limitation of this study was that the illiterate and low literacy participants of our study were mainly old illiterate women and some were not so enthusiastic in answering our questions. Another limitation is the fact that our study cannot prove that illiterate diabetic patients will perform better and have a better compliance by using these pictographs, and in order to answer this question a quantitative clinical trial should be performed.

Therefore researchers planned to use the pictographs built in this study in another study (clinical trial). In another study the results in regard to compliance will be compared between patients who were trained to use the pictographs and patients who did not use them.

Based on our experience we also suggest that researchers who intent to solve clinical problems such as drug compliance through action research should work with both clinical specialists and patients to solve their problems.

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