

4.2. Knowledge assessment

The knowledge of the participants regarding sharps disposal was evaluated using ten multiple-choice questions that covered three significant concepts: proper syringe/needle use, hazards of improper disposal, and adequate syringe/needle disposal practices with two, three, and five items, respectively, as shown in table (4.7). All 100 participating patients had baseline knowledge scores recorded. However, after the baseline visit, two patients in the nonintervention group and one in the intervention group were lost to follow-up, so, two analyses were performed : an intent-to-treat analysis with the missing observations' scores adjusted to zero, and a per-protocol analysis excluding the missing cases.

4.2.1. Knowledge scores and categories pre- and postintervention.

The distribution of the studied diabetic patients according to knowledge scores and categories pre- and postintervention has been explained in Table 4.4. The statistician tested the differences between groups regarding knowledge scores and levels at different visits by using the Wilcoxon rank sum test (Mann-Whitney). At the baseline visit (preintervention), the study findings demonstrated that there were no statistically significant differences in the knowledge levels and scores between the nonintervention and intervention groups with nearly the same levels and a median knowledge percentage score of 60 which corresponds to the fair level category for both groups. Starting with the first postintervention visit; after implantation of the program; there was a noticeable difference in subjects' knowledge levels and scores between two groups, with the intervention group significantly outperforming the nonintervention group in both measures. The first post-intervention visit results showed that the participants of the intervention group had a higher median knowledge percentage score

of 80 (80-90) which indicated a good knowledge level in both analyses, compared to the nonintervention group with 70 (60-90) and 75 (60-90) according to intent to treat analysis and per protocol analyses respectively and the difference reached statistical significance ($p<.001$). Afterward, at the second post-intervention visit, a higher median knowledge percentage score of 80 (80-90) was identified in the intervention group than in the nonintervention group at 70 (60-90) according to both analyses ($P<0.001$) and the difference was statistically significant as shown in figure (4.4).

Likewise, the current study showed that there were statistically significant differences between the two groups in terms of knowledge levels at the first and second post-intervention visits. At the first postintervention visit, it was found that the proportion of participants with a good knowledge level in the intervention group improved to 98% and 100% from 40% and 41% at baseline according to intent to treat and per protocol analyses and was higher than that of the nonintervention group which recorded 62% and 65% ($P<.001$) according to the same analyses. Moreover, the proportion of study subjects with a good level knowledge in the intervention group at the second postintervention visit was 96% and 98% according to intent to treat and per protocol analyses, respectively, in contrast to 64% and 67% in the nonintervention group ($P<.001$) (figure 4.5).

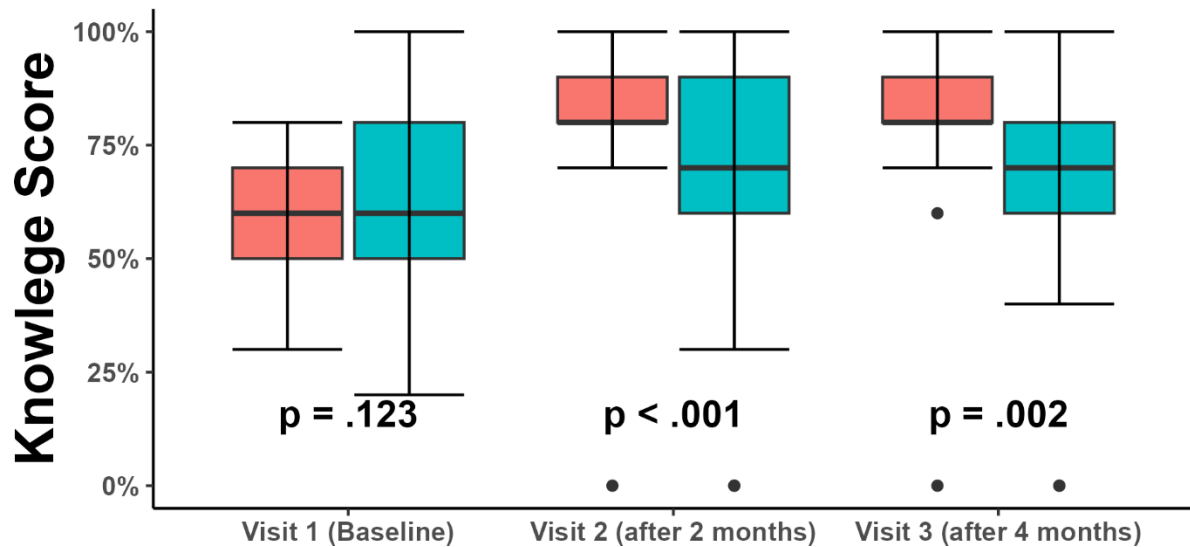
Furthermore, the persistence of a good knowledge score and level percentage over time indicates the full understanding and retention of information by patients.

Table (4.4): Distribution of the studied diabetic patients according to knowledge scores and categories pre- and postintervention (n =100) (El-Horraya polyclinic, 2023).

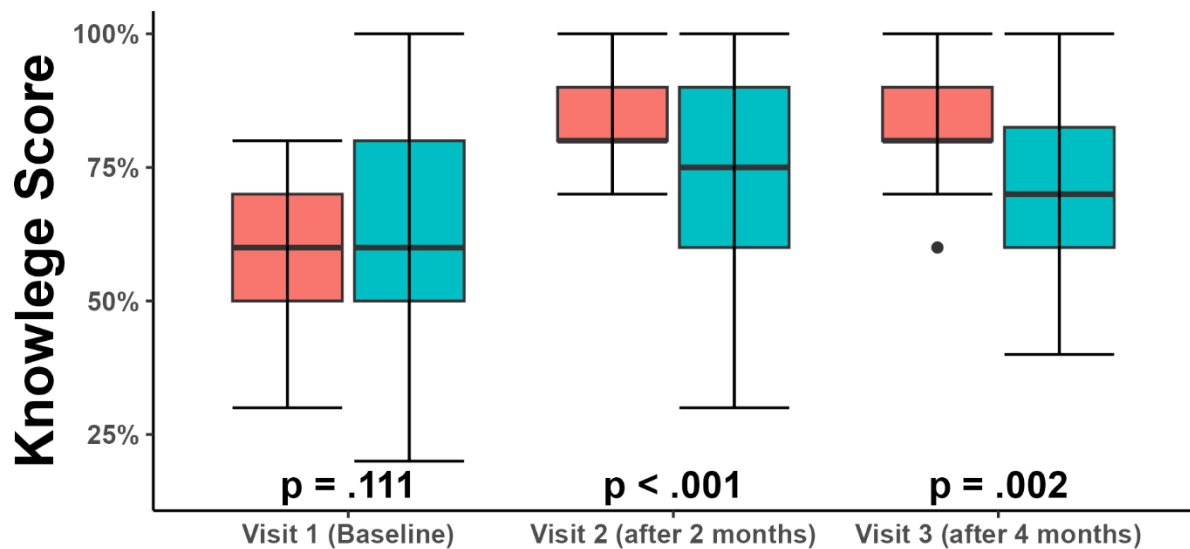
Variable	Intent to treat analysis			Per protocol analysis		
	Intervention (n = 50)	Nonintervention (n = 50)	P	Intervention (n = 49)	Nonintervention (n = 48)	P
Baseline visit						
Score, Median (IQR)	60 (50-70)	60 (50-80)	0.123	60 (50-70)	60 (50-80)	0.111
Categories						
Poor	7 (14%)	6 (12%)	0.828	6 (12%)	5 (10%)	0.828
Fair	23 (46%)	21 (42%)		23 (47%)	20 (42%)	
Good	20 (40%)	23 (46%)		20 (41%)	23 (48%)	
Median (IQR)[‡]	2 (2-3)	2 (2-3)	0.551	2 (2-3)	2 (2-3)	0.497
First post-intervention visit						
Score, Median (IQR)	80 (80-90)	70 (60-90)	<0.001*	80 (80-90)	75 (60-90)	<0.001*
Categories						
Poor	1 (2%)	3 (6%)	<0.001*	0 (0%)	1 (2%)	<0.001*
Fair	0 (0%)	16 (32%)		0 (0%)	16 (33%)	
Good	49 (98%)	31 (62%)		49 (100%)	31 (65%)	
Median (IQR)[‡]	3 (3-3)	2 (2-3)	<0.001*	3 (3-3)	3 (2-3)	<0.001*
Second post-intervention visit						
Score, Median (IQR)	80 (80-90)	70 (60-80)	0.002*	80 (80-90)	70 (60- 82.5)	0.002*
Categories						
Poor	1 (2%)	5 (10%)	<0.001*	0 (0%)	3 (6%)	<0.001*
Fair	1 (2%)	13 (26%)		1 (2%)	13 (27%)	
Good	48 (96%)	32 (64%)		48 (98%)	32 (67%)	
Median (IQR)[‡]	3 (3-3)	2 (2-3)	<0.001*	3 (3-3)	3 (2-3)	<0.001*

[‡] Median (IQR) of the levels on an ordinal scale from 1 to 3 where 1 = poor, 2 = fair, and 3 = good

Change in Knowledge Score (Intent to Treat)



Change in Knowledge Score (Per Protocol)



Group  Intervention  Non-intervention

Figure (4.4): Change in knowledge scores

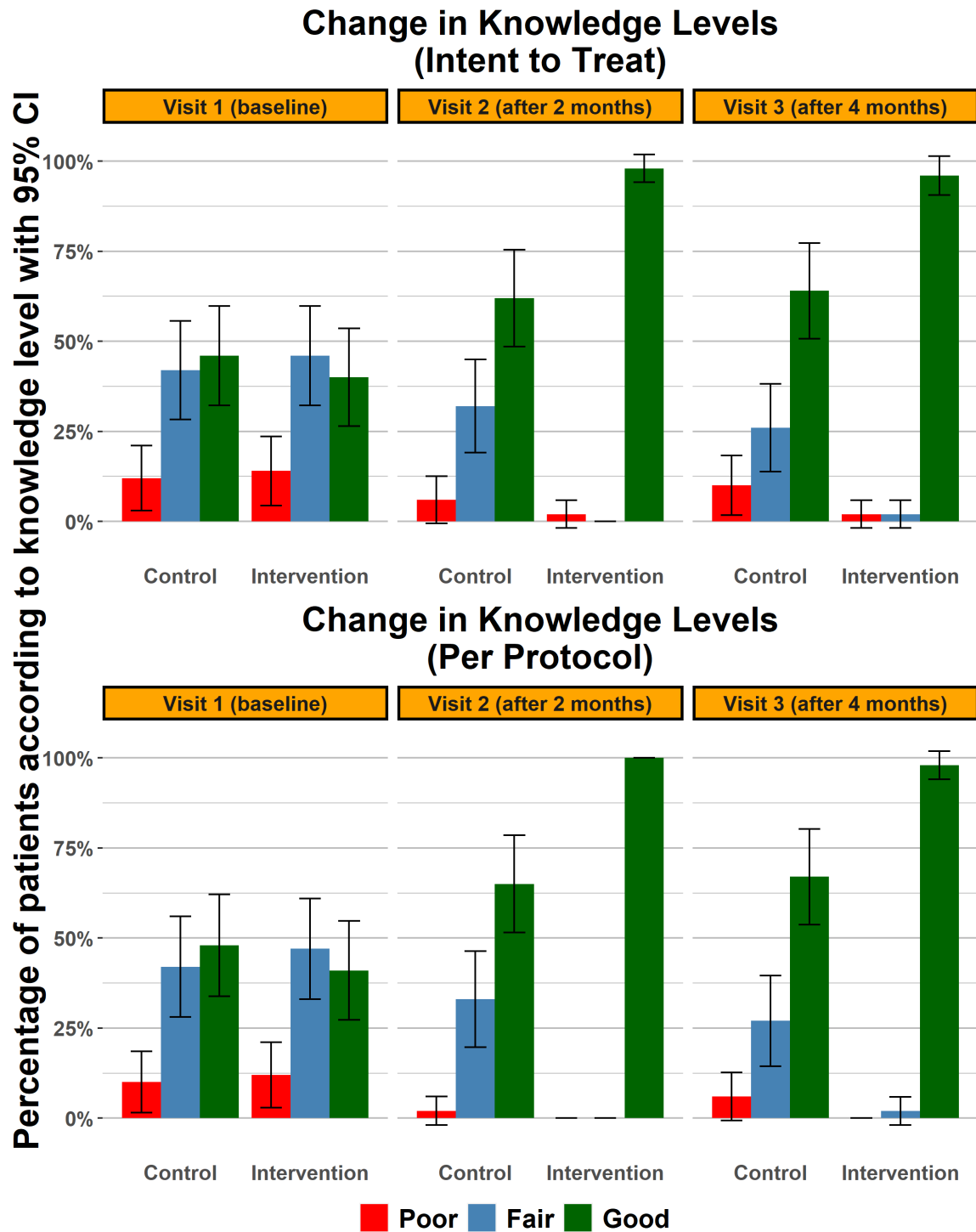


Figure (4.5): Change in knowledge levels

4.2.2. Within group difference (time effect) regarding knowledge scores and levels

The within group difference (time effect) was investigated by using the Friedman test in both groups, Table (4.5) shows the results of the Friedman tests for the repeated measures of the knowledge scores and levels. In the intervention group there were significant large differences in the knowledge scores between visits in both analyses [$X^2(2) = 79.3$, $p < 0.001$, effect size = 0.79 and $X^2(2) = 84.2$, $p < 0.001$, effect size 0.86] and significant small differences in the knowledge levels [$X^2(2) = 19.7$, $p < 0.001$, effect size = 0.20] in both analyses. In the nonintervention group, there were significant small differences in the knowledge scores [$X^2(2) = 28.5$, effect size = 0.29, $p < 0.001$, $X^2(2) = 34.9$, effect size = 0.36, $p < 0.001$] in both analyses and knowledge levels [$X^2(2) = 6.5$, effect size = 0.07, $p = 0.038$] in only intention to treat analysis rather than per protocol analysis. Subsequent post hoc pairwise comparisons were used to test the differences between each pair of visits. In the intervention group, there were substantial gains in knowledge scores and levels at first and second post-intervention visits compared to baseline visits, but no additional increases were seen at second post-intervention visit compared to second post-intervention visit according to both analyses as shown in table (4.6). Surprisingly, in the nonintervention group, there were statistically significant small increments in the knowledge scores and levels at the first and second postintervention visits compared to the baseline visit.

This finding was unexpected and suggests that the participants demonstrated willingness and readiness to obtain accurate knowledge from other sources even if they were not included in the program just when the problem was highlighted.

Table (4.5): Friedman test χ^2 values and effect sizes (Kendall W) for the repeated measures of the knowledge scores and levels

Group	Item	Intent to treat analysis				Per protocol analysis			
		Friedman χ^2 (df)	Kendall W	Effect size	<i>p</i> value	Friedman χ^2 (df)	Kendall W	Effect size	<i>P</i> value
Intervention	Score	79.3 (2)	0.79	Large	<0.001*	84.2 (2)	0.86	Large	<0.001*
	Level	19.7 (2)	0.20	Small	<0.001*	19.7 (2)	0.20	Small	<0.001*
Nonintervention	Score	28.5 (2)	0.29	Small	<0.001*	34.9 (2)	0.36	Small	<0.001*
	Level	6.5 (2)	0.07	Small	0.038*	5.3 (2)	0.05	Small	0.071

* Significant results as $p < 0.05$

Table (4.6): The pairwise comparisons in knowledge scores and levels between visits

Item	Intervention			Nonintervention		
	Baseline visit vs First postintervention visit	Baseline visit vs Second postintervention visit	First postintervention visit vs Second post-intervention visit	Baseline visit vs First postintervention visit	Baseline visit vs Second postintervention visit	First post-intervention visit vs Second postintervention visit
Intent to treat analysis						
Score	<0.001*	<0.001*	0.069	<0.001*	0.017*	0.931
Level	0.005*	<0.015*	1.000	1.000	0.890	0.520
Per protocol analysis						
Score	<0.001*	<0.001*	0.069	<0.001*	<0.001*	0.931
Level	0.005*	0.015*	1.000	NA	NA	NA

* Significant results as $p < 0.05$

4.2.3. Proportions of the correct answers to the knowledge assessment questions at each visit.

The proportions of patients in the intervention and nonintervention groups at each visit who correctly answered the knowledge assessment questions were compared by chi-square test as shown in figure (4.6). There were statistically significant differences between the intervention and nonintervention groups regarding the proportion of correct answers to the first, second, and tenth questions (significantly impacted by the educational program). However, there was no statistically significant difference between the proportions of correct answers to other questions between both groups at different visits. At first and second post-intervention visits, the intervention group outperformed the nonintervention group on questions 1 and 10 but only outperformed the nonintervention group on question 2 at the second post-intervention visit. For instance, by asking about what should be done regarding used insulin syringes during presence outside the home in the first question, there was a marked increase in percentage of participants who considered the choice of bringing the used syringes back to the home as a correct answer from 42% at baseline to 76% at both the first and the second postintervention visits while in the nonintervention group, it remained almost constant.

Next, regarding the best way to dispose of used insulin needles and syringes at the home level in the second question, there was a marked increase in the percentage of correct choices by placing them in a puncture-resistant container and disposing with household waste from 70% at the baseline visit to 100% at both the first and the second postintervention visits. The present finding seems to be consistent with Indian research which found a marked increase in the percentage of the respondents who identified the ideal way to dispose of used syringes correctly from 19% to 81%. (102) A possible explanation for this might be that such practice was significantly impacted by the educational program.

What is interesting in this question is that the majority of participants in the nonintervention group selected the correct answer at the three visits recording 84%, 94%, and 90% respectively but there was only a statistically significant difference between both groups at the second postintervention visit.

It was found that there was a surprising positive change in terms of the proportion of correct answers (plastic puncture-resistant container) to the third question which investigated the best container for safely storing used insulin syringes or needles from 38% level at baseline visit to 90% and 88% at the first and second postintervention visits respectively in the intervention group. Interestingly, the proportion of right answers to the sixth question, which concerned putting the cap back on syringes after use, not only hit the maximum value of 100% at baseline but also remained constant between groups and through visits.

Finally, regarding the tenth question which is concerned with identifying the best place to store the insulin syringes, it was found that there was a statistically significant difference between the intervention and nonintervention groups at the first and second postintervention visits regarding the percentage of respondents who considered the choice of bringing them back home as a correct answer. The results show a considerable increase in the percentage of correct answers in the intervention group from 10% at the baseline visit to 39% and 41% at the first and second postintervention visits respectively.

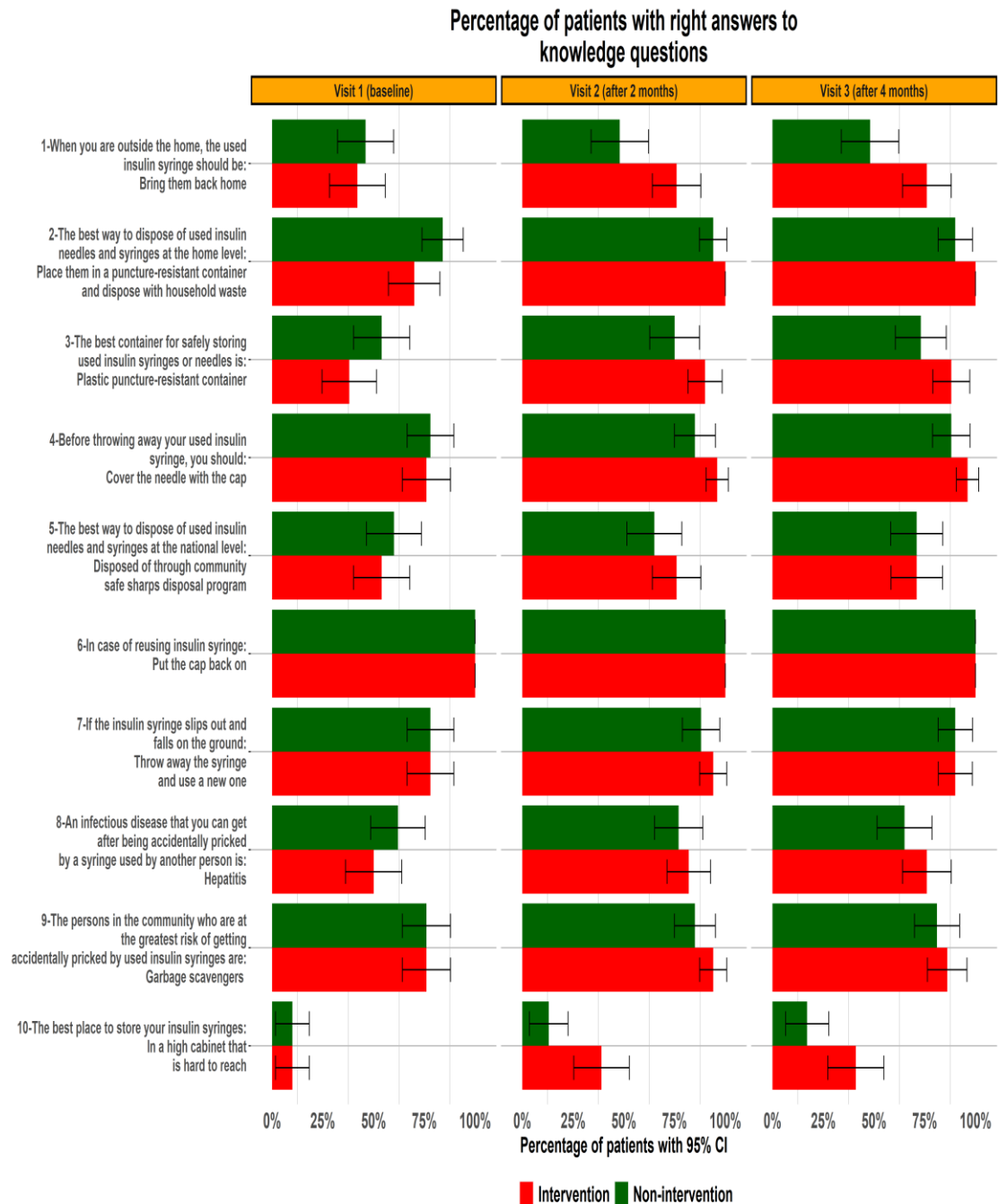


Figure (4.6): Proportions of patients with right answers to the knowledge questions at each visit