Evaluation of the role of hydroxychloroquine as a lipid profile improving and glucose adjusting drug in Egyptian females with inactive rheumatoid arthritis

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Background/aim
Rheumatoid arthritis (RA) is a chronic systemic inflammatory disease that leads to joint destruction and disability with increased risk of cardiovascular disease (CVD), a leading cause of morbidity and mortality in RA. Modifying CVD risk factors, such as lowering plasma glucose and total cholesterol, may be helpful for preventing CVD. A disease-modifying antirheumatic drugs (DMARD) hydroxychloroquine (HCQ) with a good safety profile and low cost has been reported to improve lipid profiles and glucose level in RA. The study was designed to evaluate the responsibility of HCQ in the improvement of lipid profile and glucose level in Egyptian Inactive Rheumatoid Arthritis (RA) females.

Subjects and methods
This trial study included fifty adult RA females in remission treated with 400 mg daily of HCQ orally for 6 months. The patients are regular visiting outpatient clinic of rheumatology unit at the department of Rheumatology and Rehabilitation, Mataria Teaching Hospital, National Institute of Neuro-Motor System (NINMS) and Rheumatology clinic at Centre of Medical Excellence of National Research Centre, Cairo, Egypt. Visits and follow-up are monthly to ensure adherence to treatment. All the patients have been evaluated at the start of the trial, after 3 and 6 months. Lipid profile, fasting blood sugar (FBS), anthropometric parameters and systolic and diastolic blood pressure were assessed.

Results
After 3 months of treatment, most of the metabolic characteristics were improved significantly. FBS level was significantly lowered ($P<0.001$), and lipid profiles were significantly improved as total cholesterol ($P<0.001$), HDL-cholesterol ($P<0.001$), LDL-cholesterol ($P<0.001$) and artherogenic index (TC/HDL-cholesterol ($P<0.001$) and LDL-C/HDL-cholesterol($P<0.001$). The triglyceride level and the anthropometric variables were significant statistically as ($P<0.001$). Moreover after 6 months, all metabolic parameters were statistically improved as FBS ($P<0.001$), TC ($P<0.001$), TG ($P<0.001$), HDL-Cholesterol, LDL-cholesterol and artherogenic index ($P<0.0001$). Moreover, the best improvement was at 6 months of treatment.

Conclusion
HCQ significantly improved the blood glucose level in patients with inactive RA, in addition to the serum levels of TC, TG, HDL-Cholesterol, LDL-Cholesterol and arthrogenic index. Moreover, lessen the use of anti-lipids and diabetic medications.

Keywords:
blood sugar, hydroxychloroquine, lipid profile, rheumatoid Arthritis

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Introduction

The commonness of hyperlipidemia in Rheumatoid Arthritis (RA) sufferers varied between 20 to 45% [1]. Due to the systemic chronic inflammation of RA, the patients are 1.5 to 2 times more likely than sex and age-matched controls to develop cardiovascular disease (CVD). The relationship between the disease activity of RA, lipid profile levels, and cardiovascular diseases is complex; however, inflammation plays a central part within the pathogenesis of RA, as well as atherosclerosis, dysfunction endothelial cells and microvascular dysfunction are also hypothesized to have an important role in the development of CVD in RA [2]. Moreover, factors as reducing total cholesterol levels (TC) are of great value in preventing CVD [3]. The atherogenic lipoprotein phenotype is characterized by reduced high-density lipoprotein-Cholesterol (HDL), with high levels of low density lipoprotein-Cholesterol (LDL)and

moderately elevation of triglycerides (TG) and is linked to elevated CVD risk [4].

Hydroxychloroquine (HCQ) is a synthetic derivative of 4-aminoquinolones. It is well tolerated and with an excellent safety profile [5–8]. The use of HCQ has been suggested in the management of RA as part of combination therapy [9]. Diabetes risk is reduced in tandem with this; minimizes the antithrombotic properties and atherogenic lipid profile attributable to its consequences on platelet aggregation in adjunct to its anti-inflammatory effect in RA [10]. The dyslipidemic effect could be mitigated by incorporating HCQ into RA patient's regular treatment regimen effect and reducing the cardiovascular risk, which further results in atheroma progression minimization and reduce mortality [11]. HCQ shows an expansion in glucose metabolism [12,13], glycemic control [14] and decreased risk of Diabetes Mellitus II [15]; as well as in the metabolism of lipids, through a drop in TC, serum TG and an improvement in blood levels of HDL-cholesterol [16,17].

The present study aimed to judge the responsibility of Hydroxychloroquine in the improvement of lipid profile and glucose level in Egyptian females with inactive Rheumatoid Arthritis, and the possibilities to decrease using of anti-lipids and diabetic medications and reduce the financial cost.

Subjects and methods

Patients and study design

The present research study incorporated fifty adult inactive RA female patients fulfilling the classification criteria of 2010 of American College of Rheumatology (ACR)/European League Against Rheumatism (EULAR) [18]. The patients were aged from 18 to 70 years recruited from the rheumatology clinic at the Department of Rheumatology and Rehabilitation, Mataria Teaching Hospital, National Institute of Neuro-Motor System (NINMS) and Rheumatology clinic at Centre of Medical Excellence of National Research Centre, Cairo, Egypt.

The patients followed up monthly to ensure adherence of treatment. Patients instructed not to modify their lifestyle during the time they were undergoing HCQ intervention. The follow-up assessment of the patients were done after 3 and 6 months of treatment. The assessment follow-up was for anthropometric measurements, systolic and diastolic blood pressure, profile of lipids and FBS.

Inclusion criteria

All the RA patients were treated with a steady doses of methotrexate of $\geq$10 and $\leq$25 mg per week orally or by injection and nonsteroidal Anti-inflammatory Drugs (NSAIDs), throughout the 6 months before the begin of the trial study. All the patients were in remission of the disease which is established based on the Disease Activity Score 28 (DAS28) less than 2.6 [19]. All the cases were treated with an oral dose of 400 mg HCQ daily for 6 months. All the RA patient's kidney and liver function were within normal range.

Exclusion criteria

Patients who during the last 6 months were treated with disease-modifying drugs other than methotrexate (including HCQ), as well as all those who during the last month treated with steroids at a dose exceeding 10 mg/day, indomethacin, angiotensin-converting enzyme inhibitors (ACE), metformin, β-blockers, lipid-lowering agents, sympatholytics, aspirin at doses greater than 1 g per day, or compounds with estrogen and progesterone were excluded from the trial study.

HCQ used and doses

Hydroxychloroquine is antimalarial drug which is utilized to prevent and treat malaria and also is established to treat rheumatoid arthritis, systemic lupus erythematosis and other auto-immune diseases as palindromic rheumatism and dermatomyositis. Its dose: 200 to 400 mg salt or 6.5 mg/kg salt (5 mg/kg base)/day orally divided in 1 or 2 doses [20].

Ethical consideration

The present study was conducted with the Code of Ethics of the World Medical Association, according to the principles expressed in the Declaration of Helsinki. This study has been approved by the local Ethics Committee of the General Organization for Teaching Hospitals and Institutes (GOTHI), Cairo, Egypt, with approval number HM000118,the procedure was explained to every patient and a written informed consent was provided by each participant prior to their inclusion in the study.

Methods

All the patients at the start of the study were exposed to the following procedures:

History taking, clinical examination, and DAS28 assessment,DAS28 is calculated on an App for disease activity on, a scale of 0–10, score higher than 5.1 indicates high disease activity, from 3.2 to 5.1

indicates moderate disease activity, from 2.6 to less than 3.2 indicates low disease activity and lesser than 2.6 indicates disease remission [21].

The VAS is a straight line with extreme endpoints that define 'no pain at all' and 'pain as bad as it could be.' The patient is asked to indicate his level of discomfort on the line that runs between the two endpoints [22].

Measurement of systolic and diastolic blood pressure

Subjects wearing light clothes were in sitting position with arms at heart level. Two blood pressure measurements were measured five minutes apart with an aneroid sphygmomanometer. Accepted blood pressure was the mean of two readings [23].

Measurement of weight, height, BMI and waist circumference (WC)

Following the 'International Biological Program' recommendations [24], the subjects 'body weight (Wt) was measured to the nearest 0.01 kg using a Seca Scale Balance, while the subjects wearing light clothes and without shoes. Body height (Ht) and waist circumference were measured to the nearest 0.1 cm using a Holtain portable stadiometer. WC was measured at the midpoint between the bottom of the ribs and the top of the iliac crest. Cardiovascular disease risk was at 102 cm for men and 88 for women defined as by the criteria of WHO [25]. Body mass index was calculated [BMI: weight (in kilograms) divided by height (in meters squared)].

Biochemical assessment

After 12 hours of fasting, a venous blood sample was taken to determine CBC, ESR (mm/1st hr), C-Reactive protein (CRP), Rheumatoid Factor (RF), level of fasting blood glucose (FBS)and profile of lipids. CBC was done using Sysmex analyzer XS-500i 5-part differential analysis (SysmexAmirica, Inc, US).

Fluorescence flow cytometry, (Germany).CRP and RF were assayed with a quantitative immunoflowmetry test by Elabscience lmmunofluorometric Assay Kits, (USA). FBS was measured by an enzymatic colorimetric method, using Kits of BioDiagnostic Co, (Egypt). Total cholesterol (TC), triglycerides(TG), HDL-Cholesterol and LDL-Cholesterol levels were measured using a photometric assay [26]. Arthrogenic index were premediated as TC/HDL-Cholesterol and LDL-C/HDL-Cholesterol, were also calculated.

In addition serum creatinine, blood urea, ALT, and AST levels were done using kits of Eagle Co, (Canada), at the start of the study only. The follow-up assessment of the patients was done after 3 month and 6 month (end of study). The assessment follow-up was for anthropometric measurements, systolic and diastolic blood pressure, the profile of lipids and FBS.

Statistical methods

The data were analyzed by Statistical Package for the Social Sciences 'SPSS' (Released 2017, IBM SPSS Statistics for Windows, Version 25.0. Armonk, New York: IBM Corporation). Qualitative data were presented as numbers and percentages, while quantitative data with parametric distribution were presented as mean, standard deviations and ranges. The studied parameters at baseline, after 3 months and after 6 months were compared using ANOVA and followed by post hoc analysis using Bonferoni test when significant, The confidence interval was set to 95% and the margin of error accepted was set to 5%, the *P value* was considered significant at the level of less than 0.05.

Results

Our study included fifty RA female patients with a mean age of 51.39±10.84 years and mean disease duration of 11.72±7.16 years. Their mean WC and BMI were 84.51±9.31 cm and 28.48±2.07 respectively, the data that reflected the degree of obesity of the patients. None of the patients were diabetics, 36% of them had hyperlipidemia and 30% had controlled hypertension. In these patients, RA was stable and in remission as the mean of the DAS28 was 2.32±0.19 and the mean 1st hour of ESR was 17.78±4.53 mm/h. Rheumatoid factor was positive in 32 patients (64%). The demographic, anthropometric and clinical and laboratory properties of patients at the start of the study were shown in (Table 1).

After 3 months of treatment, most of the metabolic characteristics were improved significantly. FBS level was significantly lowered ($P<0.001$), and lipid profiles was significantly improved as total cholesterol ($P<0.001$), HDL-cholesterol ($P<0.001$), LDL-cholesterol ($P<0.001$),TG ($P<0.001$), and artherogenic index (TC/HDL-cholesterol ($P<0.001$) and LDL-C/HDL-cholesterol ($P<0.001$) as shown in (Table 2).

At the end of the trial, all metabolic parameters were statistically improved as FBS ($P<0.001$), TC, TG, HDL-Cholesterol, LDL-cholesterol and arthrogenic index ($P<0.001$).

The comparison of the artherogenic index showed significant differences, as the mean of TC/HDL was

Table 1 Characteristics of females rheumatoid arthritis patients before starting the intervention

Variables	Mean±SD
Disease duration (years)	
Mean±SD	11.72±7.16
Range	5–36
DAS 28	
Mean±SD	2.32±0.19
Range	1.6–2.5
VAS score	
Mean±SD	2.98±1.58
Range	0–6
ESR (mm/h)	
Mean±SD	17.78±4.53
Range	2–22
CRP (mg/l)	
Mean±SD	3.74±1.19
Range	2–6
AST (U/l)	
Mean±SD	24.84±6.22
Range	13–38
ALT(U/l)	
Mean±SD	23.35±7.1
Range	8–39
RBCs ($\times 10^3/mm^3$)	
Mean±SD	4.39±0.46
Range	3.5–5.5
WBCs ($\times 10^3/mm^3$)	
Mean±SD	7.02±1.84
Range	3.1–13.2
Hb (g%)	
Mean±SD	11.9±1
Range	10.1–14.5
Platelets ($\times 10^3/mm^3$)	
Mean±SD	283.88±75.5
Range	169–433
Creatinine (mg/dl)	
Mean±SD	0.77±0.16
Range	0.4–1.2
Urea (mg/dl)	
Mean±SD	18.39±14.2
Range	3.4–61

ALT, Alanine Trensaminase; AST, Aspartate Amino Transferase; BMI, Body mass index; CRP, C-reactive protein; DAS: Disease Activity Score; DBP, Diastolic blood pressure; ESR, Erythrocyte Sedimentation Rate; Hg, Hemoglobin; RBCs, Red Blood Cells; SBP, systolic blood pressure; VAS: Visual analogue scale; WBCs, White Blood Cells; WC, Waist circumference.

4.14±1.0at the baseline, 3.78±0.93 after 3 months and 3.30±0.60 at the end of the study. Moreover, LDL/HDL was 3.79±1.25at the baseline, 3.38±0.92 after 3 months and 2.83±0.65 at the end of the study as $P<0.001$, as shown in (Fig. 1. In addition significant decrease in diastolic blood pressure ($P=0.045$) as shown in (Table 2).

The average difference of FBS showed a reduction by 6.58 mg/dl after 3 months of the use of HCQ on RA patients then more reduction by 3.84 mg/dl at the termination of the trial. The average differences of TC, TG and LDL showed a reduction by 4.83 mg/dl, 5.36 mg/dl and 7.69 mg/dl after 3 months, respectively and more reduction by 9.04 mg/dl, 5.65 mg/dl and 15.31 mg/dl respectively at the end of the study, while HDL showed improvement by 2.85 mg/dl after 3 months and more improvement by 4.04 mg/dl at the end of the study. All the average differences of FBS and lipid profile show significant lowering as $P<0.001$.

The adherence to treatment was 100%. Only four patients (8%) presented transient gastrointestinal disturbances of mild intensity (nausea and loose stool) during the first week of treatment that did not require discontinuation. There were no serious adverse events.

Discussion

In spite of extensive clinical utilization of HCQ in the cure of RA disease, the awareness of the mechanism of action of this drug is quite emerging [27]. Cardiovascular complications, which are the main cause of mortality and morbidity in RA patients, are an extra-articular manifestation of this autoinflammatory, self-perpetuating disease. The main risk factors for cardiovascular disease (CVD) are thought to be impaired sugar and lipid metabolism [28]. A traditional atherogenic lipid profile is indicated by raised TC, LDL-Cholesterol, and TG levels and declined HDL-Cholesterol levels [29]. Our study has been proposed to establish the role of HCQ in the improvement of lipid profile and glucose level in Egyptian inactive RA females.

Some clinical studies reported that blood glucose decreased and insulin sensitivity was recovered when there was more inflammatory activity and that improving it [30–33]. The patients who participated in this study were clinically inactive RA as the mean of DAS28 was 2.32±0.19 and the mean of ESR was 17.78 ±4.53 mm/h, suggesting that the demonstrated effect of HCQ on blood glucose was drug-specific. The patients were instructed not to modify their lifestyle during the time they were undergoing HCQ intervention.

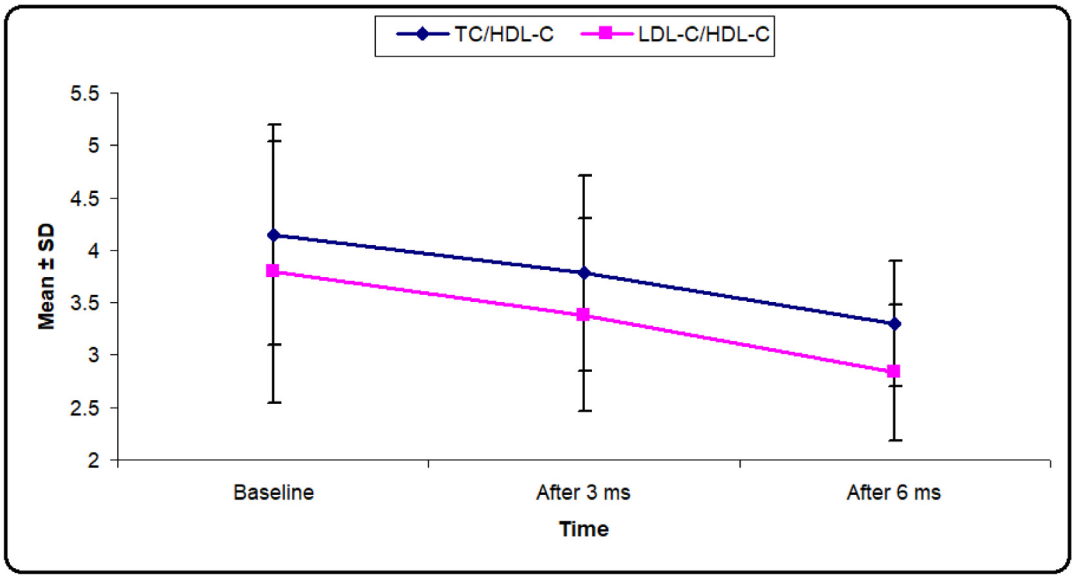
In the present study, although serum glucose levels remained within the reference limits, it had a tendency to be significant at the end of the intervention. This was in agreement with some studies in which HCQ had been shown to decrease plasma glucose levels

Table 2 Anthropometric and biochemical measurements in females rheumatoid arthritis patients at baseline, after 3 and 6 months of intervention

	Baseline	After 3 months	After 6 months	*P value*
BMI				
Mean±SD	28.48±2.07	28.00±1.45	27.96±1.43	0.140
Range	25.3–35	24.6–30.5	24.6–30.5	
WC				
Mean±SD	84.51±9.31	84.19±8.81	84.05±8.56	0.102
Range	68–105.7	68–104.6	68–101	
SBP				
Mean±SD	119.70±10.61	119.30±9.79	119.20±9.60	0.073
Range	100–150	100–140	100–140	
DBP				
Mean±SD	82.10±10.84	81.40±9.32	81.20±9.01	0.067
Range	65–115	65–100	65–100	
FBS (mg/dl)				
Mean±SD	100.52±15.54[a]	93.94±14.37[b]	90.10±12.42[c]	<0.001
Range	77–144	71–130	69–128	
TC (mg/dl)				
Mean±SD	188.68±40.83[a]	183.85±39.71[b]	174.81±29.78[c]	<0.001
Range	150–263	146–259	144–253	
TG(mg/dl)				
Mean±SD	130.84±62.70[a]	125.14±60.00[b]	119.49±54.24[c]	<0.001
Range	56–242.5	52–238.5	50–220	
HDL(mg/dl)				
Mean±SD	46.27±5.08[a]	49.12±4.24[b]	53.16±3.61[c]	<0.001
Range	36.5–56.5	39.8–58.5	43.4–62	
LDL (mg/dl)				
Mean±SD	172.76±50.88[a]	165.07±43.81[b]	149.77±33.18[c]	<0.001
Range	94.6–255.3	92.6–253.3	90.6–220	

BMI, Body mass index; DBP, Diastolic blood pressure; FBS, Fasting blood sugar; HDL, High-density lipoprotein; LDH, Low-; SBP, systolic blood pressure; TC, Total cholesterol; TG, Triglycerides; WC, Waist circumference. All data with different small superscript letter (a, b, c) are significant at $P<0.05$, using ANOVA test.

Figure 1



Comparison of the artherogenic index, TC/HDL-C and LDL-C/HDL/C in females Rheumatoid Arthritis patients at baseline, after 3 and 6 months (end of study).

[17–19,29–34]. Penn *et al.* [35] who studied 177 non-diabetic RA and 326 SLE female patients, found that serum glucose in HCQ users was lower than in nonusers as P=0.05 and concluded that HCQ use was correlated with the reduction in fasting glucose in females with SLE or RA and the utilization of HCQ may be advantageous for lowering CVD probability by enhancing glycemic control in these cases. Cansu *et al* [35] in their study, observed that HCQ is used to reduce the need for oral antidiabetics and insulin in patients with type II diabetes mellitus; non-diabetic patients with RA hypoglycemia may develop. Systematic reviews of randomized observational and controlled studies of HCQ in RA patients reported high recommendation that this molecule could have a strong role in the improvement of hyperglycemia and hyperlipidemia and protected against infections [36]. In contrast, Solomon *et al.* [37] in a double-blind cross-over study, studied 23 non-diabetic stable RA cases not utilizing HCQ anymore and finished therapy with HCQ (6.5 mg/kg per day) for 16 weeks, showed nonsignificant change in insulin resistance.

HCQ showed advantageous effects on the metabolism of lipids in RA and SLE in several clinical studies, through a decline in TC and serum TG, and an increment in blood levels of HD-C [16,17,38–40], a situation that was fully demonstrated in the present study as there was a significant difference in TC, TG, HDL-Cholesterol and LDL-Cholesterol in serum levels of Egyptian inactive RA females before and after 6 months of HCQ treatment (the end of the study).

In this study, there was a statistically significant decrement in the mean of TC as P=0.001 at the end of the study with an average reduction difference (13.87 mg/dl). These results were likewise to Restrepo *et al.* [3] who studied 1261 RA patients between 1996 and 2014 and divided them into 3 groups based on the exposure to HCQ, they recorded that the cases treated with HCQ had significantly reduction in TC (P=0.001) than nonusers. Also, the results are supported by that's of Kerr *et al.* [41] who studied 150 HCQ users & 638 HCQ nonusers, and found that HCQ users had significantly TC lower compared with nonusers as P=0.001 (TC: −13.5 mg/dl [7.4%]. The results were in congruent with the study done by Morris *et al.* [42] who studied 706 RA patients and found that the use of HCQ was analogous with significant differences in reduction of 7.70 mg/dl TC (P=0.002). Ariaza-Casillas *et al.* [43] in their study on RA patients recorded 17.9 mg/dl significant reduction in TC that agreed with our results. Similarly, other studies deduced that the utilization of HCQ in cases with RA was associated with a reduction in the levels of TC [34,37,40,44–46].

On the other hand, these results in disagreement with Rossini *et al.* [47] in a cross-sectional study that included 60 SLE patients, 56.6% of them were using a standard dosage of antimalarial drugs. Cholesterol levels were significantly differed in chloroquine users and nonusers. Also, these results were not in going with Tam *et al.* [48] who studied 65 SLE patients, 67.7% of them were HCQ users, TC, and other lipid parameters showed nonsignificant differences in both groups.

In the present study, there was a statistically significant decrement in the mean of the TGat the end of the intervention with an average reduction difference of 11.01 mg/dl. The results are identical to the study done by Restrepo *et al.* [3] who found patients taking HCQ had significantly lower TGin contrast to those who were not taking HCQ with average difference reduction of 16.8 mg/dl. Kerr *et al.* [41] in their study found that HCQ users had more favorable TG in contrast to HCQ nonusers, and mean TG was significantly reduced in the users of HCQby21.8 mg/dl (14.9%). Also these results were in accordance with a study done by Morris *et al.* [42], who studied 706 RA patients and found that HCQ use was affiliated with TG lowering of 10.91 mg/dl, but these findings were not statistically significant. Also our results are analogous to the research done by Wallace *et al.* [39] who found that the treatment with HCQ had a statistical correlation with low levels of serum TG irrespective of accompanying steroid management. These results were supported by the study done by Meng *et al.* [45] who found that there were statistical differences in the levels of TG before and after HCQ dosing. These results were agreed with a study done by Rho *et al.* [49] who studied 169RA patients, (42) HCQ users and 127 HCQ nonusers, existent use of antimalarial therapy (especially HCQ) was linked with significant reduction in TG with average difference 52.2 mg/dl. Otherwise, in the study done by Solomon *et al.* [37] they found no levels changed of TG during HCQ treatment with an average insignificant difference of 3.2 mg/dl.

In this trial, the mean of HDL levels was significantly improved as P<0.001 at 6 months with an average difference (4.06 mg/dl). These results were in accordance with a study done by Restrepo *et al.* [3] who found patients taking HCQ had significantly higher HDL in contrast to cases who were not

taking HCQ with average improvement by 6.87 mg/dL. The results were supported by a study done by Meng *et al.* [45] who found that there were statistically significant differences in the levels of HDL before and after HCQ dosing in RA patients. Similarly, the studies done by Penn *et al.* [34] and Rho *et al.* [49] announced that the use of HCQ in RA patients was linked with a significant increase in HDL levels by 3.2 mg/dl and 5.1 mg/dl respectively. On the other hand, studies done by Solomon *et al.* [37] and Wallace *et al.* [38] found no change during HCQ treatment on HDL in RA patients.

In the present study, there was a significant reduction in the mean of LDL as $P<0.0001$ at the end of intervention with an average reduction difference (23.0 mg/dl). The results were in accordance with a study done by Restrepo *et al.* [3] who reported the cases utilizing HCQ had significantly reduced LDL ($P<0.001$) compared with HCQ nonusers with average decrease of 9.3 mg/dl ($P<0.001$). Also, these results were carried out by Kerr *et al.* [41]. Morris *et al.* [42] in their study deduced that HCQ use was affiliated with a significant LDL lowering of 7.55 mg/dl ($P< 0.001$). Also these results established by Solomon *et al.* [37] who inaugurated during the HCQ treatment period, LDL levels were reduced by 12.4 mg/dl compared to the placebo, these showed statistical significant lowering ($P<0.05$). Rho *et al.* [49] reported that HCQ users linked with lower LDL ($P=0.03$). Similarly, other studies confirmed that RA cases using HCQ was correlated with decrement in LDL [34,40,45,48].

As regards the artherogenic index in our study, there was a statistically significant improvement in the mean of TC/HDL and LDL/HDL as $P=<0.001$ at the termination of the trial. These results were supported by other studies [3,4,43,44,46] that confirmed improvement in artherogenic index in HCQ users than nonusers with a statistical significance difference. On the other hand, these results were not in going with Tam *et al.* [48] who deduced that there were insignificant differences in TC/HDL or other lipid parameters between the users and nonusers of HCQ.

Raised risk of cardiovascular disease CVD the most important cause of increase in morbidity and mortality in RA is related to disease activity and chronic inflammation with traditional risk factors [50]. HCQ as DMARD is a good safety profile and inexpensive drug has been established to improve lipid parameters and glucose level in RA [3].

Finally, HCQ in general, was well accepted in the trial cases and no serious disadvantageous actions were announced. The percentage of gastrointestinal symptoms was less than 15% and all transient, which is consistent with that reported in the literature [51]. Another unfavorable effect that may occur due to the use of antimalarials in patients with RA is retinopathy, which has been reported up to 10% with the use of chloroquine and approximately 1% with prolonged use (more than five years) of HCQ [40] With regard to the use of the latter drug, a dose of 200 to 400 mg daily (≤6 mg/kg/day) is recommended. There are no reported cases of HCQ retinopathy with the dose and frequency used in this investigation.

Conclusion

The supplementary management objective in RA is reducing or abolishing the exact related CVD incidents that accelerate considerable morbidity and mortality. The administration of 400 mg daily of HCQ orally for 6 months, significantly improved the blood glucose level in patients with inactive RA, as well as the serum lipid parameters, artherogenic index (TC/HDL-Cholesterol and LDL-C/HDL-C) and lessen the use of more anti-lipids as statins and diabetic medications in Egyptian females with inactive Rheumatoid Arthritis.

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Conflicts of interest

There are no conflicts of interest.

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