Original Article

Cardiometabolic Risk Marker Changes in Centrally Obese Women Using Depot Medroxyprogesterone Acetate (DMPA) in Kigali, Rwanda

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Abstract

Background
Hormonal contraceptives, such as depot medroxyprogesterone acetate (DMPA), are known to increase the risk of cardiometabolic disease, especially in obese users who are already at high risk.

Objectives
This study aimed to evaluate changes in lipid profile, glycated hemoglobin (HbA1C), blood pressure (BP), and inflammatory markers over a 12-month follow-up in centrally obese women using DMPA in Rwanda.

Methods
A prospective study involving 65 abdominally obese women (aged 15-49 years) was conducted at two family planning centres in Kigali. Measurements were taken at baseline, six months, and twelve months, including a lipid profile, HbA1c, BP, and high-sensitivity C-reactive protein (hs-CRP). Changes were analyzed using the Wilcoxon signed-rank test, with a significance level of 5%.

Results
The study demonstrated significant changes in the median of cardiometabolic parameters over 12 months of DMPA use. WC increased from 96(41) to 99.5(44) cm, TG from 1.15(2.40) to 1.53(3.63) mmol/L, while HDL-c decreased from 1.09(1.55) to 0.90(0.99) mmol/L (all P=0.001). Lipid ratios also increased significantly, where the TC/HDL-c increased from 3.54(5.92) to 5.99(8.58), and LDL-c/HDL-c from 2.63(4.8) to 4.68(7.38) (P=0.001).

Conclusion
Given these findings, assessing central obesity before initiating DMPA and performing cardiovascular risk evaluations every six months is recommended to mitigate adverse effects.
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Keywords: Central obesity, reproductive health, DMPA, Cardiometabolic risk markers, Contraceptive use

Introduction

The use of hormonal contraceptives has been repeatedly reported to increase the risk of cardiometabolic disease due to its influence on cardiometabolic risk factors,[1,2] and the risk worsens for abdominally obese users who are already at high risk. Cardiometabolic risk is defined as a clustering of metabolic factors that increase the risk of cardiovascular diseases (CVD) and/or type 2 diabetes mellitus.[3] The top five metabolic factors indicating cardiometabolic risk include abdominal obesity, atherogenic dyslipidemia manifested by high serum triglycerides (TG) level and/or low high-density lipoprotein cholesterol (HDL-c), high blood pressure, insulin resistance, and a pro-inflammatory state primarily manifested as an abnormal level of high sensitivity C-reactive protein (hs-CRP).[4, 5] An individual is diagnosed with cardiometabolic syndrome (CMS) when he/she has central obesity plus any other two of the factors.[6] The CMS is a strong risk factor for type 2 diabetes and many forms of CVD, including coronary artery disease, peripheral vascular diseases, myocardial infarction, ischemic heart disease (IHD), and stroke.[7]

Previous studies have indicated that women with CMS have a higher CVD mortality rate than men[8] and an increased risk of developing IHD compared to men.[9] The observed difference between men and women may be associated with the high prevalence of central obesity among women compared to men, which, in women, is highly associated with multiple cardiometabolic risk factors such as dyslipidemia, hypertension, and impaired fasting blood glucose.[10] Literature highlights central obesity as an estimator of cardiometabolic risk compared to the body mass index (BMI),[11,12] which typically concerns height and weight but does not provide information regarding body fat distribution. It has been reported that central obesity is not always associated with higher BMI, as very recent studies reported that the prevalence of normal-weight central obesity in Africa varies between 27 and 39%.[13,14] Unfortunately, central obesity remains a global concern in women of reproductive age (15-49 years), the same age category as the predominant users of contraceptives. For instance, in Rwanda, the Demographic Health Survey 2020 (DHS) shows that obesity/overweight among women aged 15 to 49 years has gradually increased over the years: it was 12% in 2005, 16% in 2010, 21% in 2015, and 26% in 2020. The survey also indicates a higher prevalence in urban-based populations (42%) than in rural areas (22%), with a high prevalence in Kigali (43%).[13] Central obesity was consistently reported to be higher in women than in men; for instance, a study by Mohamed et al. (2019) in Nairobi-Kenya reported a prevalence of 75.6% among women and 24.4% among men,[12] whilst a study by Yayehd et al. (2017) in Togo reported a prevalence of 56.1% in women and 9.2% in men.[14] Another study by Yohannes Tekalegn et al. (2022) in Ethiopia reported a prevalence of 53% in women and 15% in men.[15] The increased prevalence of obesity among women compared to men may be associated with the use of hormonal contraceptives, mainly depo medroxyprogesterone acetate (DMPA) injection, also called Depo Provera.[10] This injection is generally administered on a three-month basis and is used for both treating endometriosis and preventing pregnancy.[16]

DMPA is a widely used hormonal contraceptive method favored by many women globally, particularly in Sub-Saharan Africa, with a notable prevalence in East Africa, including Rwanda.[17,18] However, previous research has raised concerns about its possible effects on cardiometabolic risk factors, which play a crucial role in the onset of cardiovascular disease (CVD),[19,20,21] a leading cause of chronic illness and mortality worldwide.[22] Generally, the injection has been consistently reported to be associated with weight gain, with a larger trend observed in users who initiated this contraception modality whilst they were already obese.

It was reported in a study conducted among adolescent girls in a prospective 18-month follow-up study, where the mean increase in weight at 18 months was 9.4 kg in obese users and 3.5 kg in non-obese.[23] The same trend was reported in Indian postpartum women, where the six-month follow-up study indicated a significant progressive increase in weight.[24] In a cross-sectional study conducted in Ethiopia, there was a significant increase in individual body weight from 1-14 kg and a mean increase of 5kg/m^2 in BMI regardless of the duration of use.[25]

The current guidelines urge caution on using DMPA in women with multiple cardiometabolic risk factors. An evaluation of cardiometabolic risk factors is recommended before initiating DMPA to minimize risks for CVDs. For instance, the New Zealand guidelines recommend that DMPA should not be used for women with hypertension and should be used with caution for women with metabolic risk factors of cardiovascular disease like obesity, dyslipidemia, and diabetes.[26] Further, the WHO guidelines recommend stopping the use of DMPA for women with multiple cardiovascular risk factors when such woman contracts hypertension or show rapid weight gain [16]. Moreover, the updated checklist of Family Health International 2015 recommends a prior evaluation before initiating DMPA for smokers and users who are obese, hypertensive, or have hyperglycemia, as these can increase the risk of heart attack or strokes.[27]

However, in most African countries, including Rwanda, women are only screened for hypertension and will be initiated on DMPA regardless of the status of other cardiometabolic risk factors. Furthermore, there is no follow-up to check for any cardiometabolic health risk that could arise from this method of contraception. The lack of follow-up on cardiometabolic risk factors might be associated with the perceived high cost of screening inconvenience in under-resourced settings, which indicates the need for an effective and cost-friendly mechanism to assess cardiometabolic risk. This study attempts to bridge the knowledge gap by assessing how informative the measures of central obesity before initiating DMPA and routine follow-up in obese users can be to reduce the risks of CVDs. The study describes changes in the lipid profile, glycated haemoglobin, blood pressure, and inflammatory markers over 12 months in centrally obese individuals following initiation of DMPA in Rwandan women seeking family planning services in Kigali.

Materials and methods

Study setting and design

The study used an observational design with a prospective approach. Data were collected thrice a year: at baseline, after six months, and after 12 months. We recruited participants from two selected family planning centres in Kigali, Gahanga, and Gikondo, which were chosen because they are among the centres with a high volume of women because family planning services are free of charge at these centres. Each centre receives approximately 30 women daily, five days per week, and the DMPA choice is about 4-7 people per day for each centre.

Participants' selection

The potential participants were non-pregnant, abdominally obese, apparently healthy women aged between 15 and 49 years. Participants were required to be non-users of hormonal contraceptives for at least six months prior to enrollment and expressed a desire to initiate or restart DMPA. Based on participants' self-reports, the study excluded participants with a history of chronic diseases such as diabetes mellitus, heart diseases, kidney diseases, pronounced hypertension, and HIV infection, as these diseases are more likely to be associated with heart diseases. Centrally obese women were defined at baseline by measuring waist circumference, and central obesity was defined as a waist circumference ≥ 88 cm.[8]

Sample size and sampling procedures

The study involved 65 participants, estimated based on the formula designed for cohort studies with pre-post-study design.[28] Considering a significant level of 5% and a power of the test of 80%, calculations were made based on total cholesterol data reported by Odelola et al.(2023), where the mean difference between baseline and after six months of DMPA use was 2.8 while the standard deviation of difference was 7.1[2]. The minimum sample size was estimated to be 51 participants, and with the assumption of an attrition rate of 20%, the sample was adjusted to 64 participants.

Baseline data were corrected from September to November 2020, the second from April to May 2021, and the third from November to October 2021. During baseline data collection, we contacted 156 DMPA users, and 77 of them were centrally obese. Among these 77 centrally obese women, only 65 participants met the inclusion criteria and were purposively all included in the study.

Data collection and measurements

A structured questionnaire was administered to collect demographic and lifestyle data from participants: age, parity, educational attainment, physical activity level, alcohol consumption, dietary habits, and blood pressure readings. Consenting participants also provided fasting blood specimens for determining lipid profiles, HbA1c, and hs-CRP. The follow-up data on waist circumference, blood pressure, lipid profile, HbA1c, and hs-CRP were collected at six and twelve months.

The age was recorded in years, while educational attainment was categorized as secondary or less and tertiary. The education attainment was kept to only two categories for analysis purposes, as the other categories were underpowered. Physical activity was described as a sedentary and non-sedentary lifestyle based on daily activity, as none of the participants reported doing planned physical exercise. The sedentary style was defined by occupations that do not require much energy where an individual spends much time sitting,[29] such as housekeeping, sewing and handcrafting, and boutique and office work. Non-sedentary style included activities that allow energy expenditure, such as farming, mobile business, and building activities. Alcohol intake was measured as a binary variable, and dietary intake was self-reported based on the number of times per week the participants consumed meat, milk, and vegetables, with the preceding four weeks before enrolment taken into account. Blood pressure was measured based on the International Association of Hypertension, where a systolic blood pressure ≥ 130 mmHg and/or diastolic blood pressure ≥ 85 mmHg is considered elevated, while blood pressure below these values is considered normal.[30] Additionally, waist circumference was measured using tape, specifically at the narrowest width between the lowest rib and the iliac crest. This measurement was taken on the bare skin, with the participant's arms resting naturally at their sides and at the end of a normal exhalation.

The blood samples were analyzed using the clinical chemistry analyzer named Abbott ARCHITECTci4100. This clinical chemistry analyzer is an automated machine that detects lipids using enzymatic and colorimetric methods and expresses the results in mmol/L. It detects hs-CRP by immunoassay method and expresses it in mg/L, while it detects the HbA1c by enzymatic method and expresses it in %.
Lipid profiles included total cholesterol (TC), low-density lipoprotein cholesterol (LDL-c), high-density lipoprotein cholesterol (HDL-c), and triglycerides (TG). Abnormal results were defined for TC ≥ 5.2 mmol/L, LDL-c ≥ 2.59 mmol/L, HDL-c < 1.29, and TG ≥ 1.7 mmol/L.[31] An elevated HbA1c value was defined as HbA1c ≥ 5.7 %, while a value below 5.7 % was considered normal.[32] After laboratory analysis, lipid ratios TC/HDL-c, TG/HDL-c and LD-cL/HDL-c were calculated. The TC/HDL-c ratio ≥ 3.5 indicates a high risk of cardiovascular disease, while a value below 3.5 indicates a low risk.

Subsequently, an LDL-c/HDL-c ratio ≥ 2.5 indicates high risk, while a value below 2.5 indicates low risk, and a TG/HDL-c ratio < 3 indicates low risk, while a ratio greater than 3 indicates increased risk.[33] The HbA1-c, as a predictor marker of coronary artery disease in non-diabetic individuals, was used to categorize the CVD risk; participants with HbA1-c of < 5.7% were considered low risk, while those with a value ≥5.7% were classified as having high risk.[34] We measured hs-CRP for inflammatory markers, a measure of low-grade chronic or systemic inflammation. The hs-CRP method detects the concentration of C-reactive protein that cannot be detected by the routine method; hs-CRP detects CRP in the range of 0- 10 mg/L, while the routine method detects CRP from 10-1000 mg/L. The hs-CRP level is used to categorize the risk of CVD where hs-CRP < 1 mg/L indicates low risk, 1 ≤ hs-CRP < 3 mg/L indicates moderate risk, while hs-CRP ≥ 3 mg/L indicates a high risk.[35] For analysis, the hs-CRP variable was grouped into two categories: low risk for the value below 3 mg/dl and high risk for the value of 3 mg/dl and above.

Data management and analysis

After data collection, data were entered, cleared, processed, and analyzed using SPSS version 20. Data were presented in tables and expressed as percentages or median (interquartile range). Cochran's Q test, used to analyze repeated measures or matched data where the outcome is binary, was used to determine whether there are significant differences in proportions across groups. The Shapiro–Wilk Test for normality was performed to decide on the appropriate statistical test, and it was indicated that none of the variables respected normal distribution. Consequently, the non-parametric statistical test, the Wilcoxon signed-rank test, was used to compare two paired groups (before and after a given period of DMPA use) at each time point. The level of significance was fixed at 5%.

Ethics and consent

The study was approved by the Institutional Review Board of the University of Rwanda (Reference: 042/CMHS IRB/2020). Permission was granted by the Rwanda Biomedical Center (Reference: 417/RBC/2020) and the Rwanda Ministry of Health (Reference: NHR/2020/PROT/030). The consent form indicating the study's purpose, importance, and involvement was prepared in the local language (Kinyarwanda) and given to participants willing to participate. Participants could all read Kinyarwanda and were given time to read the consent form and ask questions related to the research. Those willing to participate in the study signed the written consent form before commencing data collection.

Results

Bio-demographic characteristics

Table 1 shows the bio-demographic characteristics of the study participants. The ages ranged between 20 and 45 years, with a median of 26(25) years. Most participants, 46 (70%), had attained less than a secondary school education level, and most led sedentary lifestyles 48 (73.8%).

Further, Table 1 shows that 38 (58.5%) of the women were breastfeeding, and 45 (69.2%) had less than three children at the time of data collection. Concerning diet, 30 (46.2%) take alcohol, 45 (69.2%) reported they consume meat at least once a week, 37 (56%) consume vegetables, 51 (78%) consume fruits, and 43 (66%) consume milk at least once a week.

Table 1. Bio-demographic characteristics of study participants

Parameters	Categories	Median age (Range)	Frequency (%)
Age (in years)		26 (25)	
Education attainment	Less than secondary		46 (70.8)
	Secondary or tertiary		19 (29.2)
Physical activity	Sedentary		48 (73.8)
	Non-sedentary		17 (26.1)
Breastfeeding	Yes		38 (58.5)
	No		27 (41.5)
Parity	< 3 children		45 (69.2)
	≥ 3 children		20 (30.8)
Alcohol use	Yes		30 (46.2)
	No		35 (53.8)
Meat consumption	Not at all		20 (30.8)
	At least once a week		45 (69.2)
Vegetable consumption	< 4 times a week		28 (43.1)
	≥ 4 times a week		37 (56.9)
Fruits consumption	Not at all		14 (21.5)
	At least once a week		51 (78.5)
Milk consumption	Not at all		22 (33.8)
	At least once a week		43 (66.3)

Variation in proportions of participants with increased cardiometabolic risk

At baseline, there were 65 participants in the study. After six months of follow-up, two participants withdrew due to bleeding complications. After twelve months, an additional five participants were lost to follow-up: three switched methods, one desired to become pregnant, and one left for unknown reasons. Thus, 58 participants completed the twelve-month follow-up.

According to the data presented in Table 2, the TC/HDL-c lipid ratio indicated that 52% of participants were at high risk for cardiometabolic disease at baseline. This proportion increased significantly to 85% at six months and 96% at twelve months; P=0.001. The results on LDL-c/HDL-c indicate that 56% of participants had high risk at baseline, and the proportion increased significantly at six months (87%) and after 12 months of follow-up (96%); P= 0.001. However, the proportion of participants with abnormal TG/HDL-c ratio did not change significantly over twelve months of follow-up, as it was 3% at baseline, 4.8% at six months and 8.6% after twelve months; P=0.497. Regarding HDL-c levels, 75% of participants were at high risk of cardiometabolic disease at baseline, and the proportion increased significantly to 95% at six months and 96% at twelve months; P=0.001. According to TG results, 13%, 25%, and 39% of participants indicated high risk at baseline, six months and twelve months, respectively, and the change was statistically significant; P=0.003.

The results on hs-CRP indicate that 24% of participants indicated high-risk cardiometabolic disease at baseline, and the proportion rose significantly to 27% at six months and 51% at twelve months; P=0.001. Results on HbA1c showed that 26%, 23%, and 41% of participants had high risk at baseline, six months and after 12 twelve months of follow-up, and this rise was statistically significant; P=0.039.

Data on blood pressure showed that 9% of participants had elevated SBP, and the proportion increased significantly to 22% at six months and 41% at twelve months; P=0.001. In the same way, participants with elevated DBP were 23%, 24% and 45% at baseline, six months, and 12 months, and the rise was statistically significant; P=0.011.

Table 2. Variation of proportions of participants with increased risk of cardiometabolic disease during twelve months of follow-up

Variable	Risk associated	Baseline, N=65 n(%)	Six months, N=63 n(%)	12 months, N=58 n(%)	P-value
TC/HDL-c					
<3.5	Low risk	31(47.7)	9(14.3)	2(3.4)	0.001
≥3.5	High risk	34(52.8)	54(85.7)	56(96.6)	
LDL-c/HDL-c					
<2.5	Low risk	28(43.1)	8(12.8)	3(5.2)	0.001
≥2.5	High risk	37(56.9)	55(87.3)	55(94.8)	
TG/HDL-c					
≤3	Low risk	63(96.9)	60(95.2)	53(91.4)	0.497
>3	High risk	2(3.1)	3(4.8)	5(8.6)	
HDL-c					
≥1.29	Low risk	16(24.6)	3(4.8)	2(3.4)	0.001
<1.29	High risk	49(75.4)	60(95.2)	56(96.6)	
hs-CRP					
<3	Low risk	49(75.4)	46(73)	28(48.3)	0.001
≥3	High risk	16(24.6)	17(27)	30(51.7)	
TG					
< 1.7	Low risk	56(86.2)	47(74.6)	35(60.3)	0.003
≥1.7	High risk	9(13.8)	16(25.4)	23(39.7)	
HbA1c					
<5.7	Low risk	48(73.8)	48(76.2)	34(52.3)	0.039
≥5.7	High risk	15(26.2)	15(23.8)	24(41.4)	
SBP					
<130	Low risk	59(90.8)	49(77.8)	34(58.6)	0.001
≥130	High risk	6(9.2)	14(22.8)	24(41.4)	
DBP					
<85	Low risk	50(76.8)	48(76.2)	32(55.2)	0.011
≥85	High risk	15(23.1)	15(23.8)	26(44.8)	

DBP: Diastolic blood pressure (in mmHg), SBP: Systolic blood pressure (in mmHg), HDL: High-density lipoprotein cholesterol (in mmol/L), LDL: Low-density lipoprotein cholesterol (in mmol/L), TC: Total cholesterol (in mmol/L), TG: Triglyceride (in mmol/L), HbA1c: Glycated hemoglobin (in %), hs-CRP-high-sensitivity C-reactive protein (in mg/L).

Changes in cardiometabolic parameters

Table 3 shows the changes in cardiometabolic parameters, comparing the baseline data at six months of use and the six-month follow-up data and those after 12 months. The baseline waist circumference changed significantly from the median of 96(41) cm to 98(43) cm; P=0.001 in six months and 99.50 cm (44); P=0,001 in twelve months. Similarly, the median total cholesterol increased from the median of 3.93(3.96) mmol/L to 4.27(4.28) mmol/L; P=0.016 in six months and 5.06(5.11) mmol/L; P=0.001 in twelve months. The median LDL-c increased from 2.90(3.19) mmol/L to 3.26(3.46) mmol/L; P=0.019 in six months and 3.96(4.64) mmol/L; P=0.001 in 12 months, while the median HDL-c decreased from 1.08 (1.55) mmol/L to 0.94(1) mmol/L; P=0.001 after six months, and to 0.90(0.99) mmol/L; P=0.005) after twelve months.

Table 3. Changes in cardiometabolic markers between baseline and six months and between six months and 12 months of follow-up among abnormally obese women using DMPA

Variable	Baseline		At six months			At 12 months		
	Median (IQR)	*95%CI*	*Median (IQR)*	*95%CI*	*P-Value*	*Median (IQR)*	*95%CI*	*P-Value*
WC	96 (41)	(93-98)	98 (43)	(96-100)	0.001	99.50(44)	(97.4-104)	0.001
TC	3.93(3.96)	(3.74-4.12)	4.27(4.28)	(4.09-4.6)	0.016	5.06 (5.11)	(4.71-5.36)	0.001
LDL-c	2.90(3.19)	(2.69-3.01)	3.26(3.46)	(3.07-3.55)	0.019	3.96 (4.64)	(3.60-4.31)	0.001
HDL-c	1.08(1.55)	(1.05-1.12)	0.98(1.00)	(0.91-1.02)	0.001	0.90(0.99)	(0.81-1.00)	0.005
TG	1.15(2.40)	(1.06-1.23)	1.27(3.30)	(1.12-1.52)	0.007	1.53(3.63)	(1.40-1.70)	0.038
TG/HDL-c	1.06(2.89)	(0.94-1.23)	1.5(4.29)	(1.28-1.65)	0.001	1.85(3.63)	(1.55-2.17)	0.025
TC/HDL-c	3.54(5.92)	(3.21-3.96)	4.65(6.56)	(4.33-5.12)	0.001	5.99(8.58)	(5.57-6.44)	0.001
LDL-c/HDL-c	2.63(4.80)	(2.34-2.81)	3.48(6.12)	(3.13-3.85)	0.001	4.68(7.38)	(4.26-5.01)	0.001
SBP	121(43)	(118-122)	122(53)	(117-124)	0.390	127(51)	(120-132)	0.001
DBP	79(37)	(76-81)	79(41)	(77-82)	0.727	84(47)	(80-87)	0.013
HbA1c	5.0 (3.02)	(4.80-5.40)	5.23(3.07)	(5.0-5.5)	0.752	5.48(3.11)	(5.27-5.82)	0.001
hs-CRP	1.05(9.66)	(0.56-1.65)	1.21(9.06)	(0.95-2.0)	0.926	3.16(9.75)	(1.58-4.66)	0.001

IQR: Interquartile range, WC: Waist circumference (in cm), DBP: Diastolic blood pressure (in mmHg), HDL: High-density lipoprotein cholesterol (in mmol/L), LDL: Low-density lipoprotein cholesterol (in mmol/L), SBP: Systolic blood pressure (in mmHg), TC: Total cholesterol (in mmol/L), TG: Triglyceride (in mmol/L), HbA1C: Glycated hemoglobin (in %), hs-CRP-high-sensitivity C-reactive protein (in mg/L).

In addition, the data in Table 3 show increases in median TG from 1.15(2.4) mmol/L to 1.27(3.3) mmol/L; P<0.007 in six months and 1.57(3.63) mmol/L; P=0.038, in twelve months. The median TG/HDL-c ratio increased from 1.06(2.89) to 1.50(4.29) in six months; P=0.001 and to 1.85(3.63) at twelve months; P=0.025. The median TC/HDL-c ratio increased from 3.54 (5.92) to 4.65(6.56); P=0.001 in six months and 5.99(8.58) in twelve months; P=0.001, while the median LDL-c/HDL-c ratio increased from 2.63(4.80) to 3.47 (6.12); P= 0.001) in six months, and 4.68 (7.38) in twelve months; P=0.001.

Furthermore, systolic blood pressure (SBP) and diastolic blood pressure (DBP) also increased. After six months of follow-up, the median SBP shifted from 121(43) mmHg to 122(53) mmHg; P=0.001, and 127(51) mmHg, P=0.001 in twelve months, while the median DBP marginally increased from 79(37) mmHg to 79(41) mmHg, in six months; P= 0.727, and to 84(47) mmHg; P= 0.013 in twelve months.

Similarly, the median % HbA1C increased slightly from 5.0(3.03) % to 5.23(3.07) % in six months, P=0.752, and 5.48(3.11) %; P= 0.001 in twelve months, while the median hs-CRP changed from 1.05(9.66) mg/dL to 1.21(9.06) mg/dL; P=0.926 in six months, and to 3.16(9.75) mg/dL; P=0.001 in twelve months.

Discussion

The purpose of this study was to determine the effect of DMPA injection on cardiometabolic risk markers among abdominally obese women of reproductive age in Rwanda. The aim was to inform health professionals providing hormonal contraceptives of the need to check the degree of central obesity before the initiation of DMPA and to conduct routine follow-ups with obese users to reduce the risks of CVDs. In this twelve-month prospective study, participants experienced significant alterations in lipid profile components and lipid ratios with no significant change observed in median % HbA1c, blood pressure, and hs-CRP after six months of follow-up. However, after a twelve-month follow-up, participants experienced a significant increase in median TC, TG, LDL-c,

lipid ratios, systolic and diastolic blood pressure, HbA1c, and hs-CRP. These findings support the hypothesis that obese women using DMPA are likely to experience an enhanced cardiometabolic risk.

The study argues that visceral fat deposition in DMPA users increases gradually with time. Elffers et al.,(2017) reported comparable findings, noting a significant increase in mean central fat deposition among DMPA users.[10] This gradual increase in abdominal fat deposition bears potential health risks if the changes are not reversed upon DMPA discontinuation. Furthermore, other studies reported that central obesity was associated with chronic systemic inflammation, CVDs, and many other metabolic diseases like diabetes mellitus, hypertension, microalbuminuria, atherosclerosis, arthritis, and some cancers. [36]

Furthermore, the study confirms that within 12 months of follow-up, DMPA users experience a gradual increase in median TG/LDL-c and TC and a decrease in HDL-c levels. These findings agree with those of a similar prospective study conducted in India among postpartum women, which reported a progressive increase in serum TG, LDL-c, and TC and a decrease in HDL-c in DMPA users.[24] However, there is some discordance with findings from a study conducted in Nigeria, which reported an increase in serum LDL-c and a decrease in HDL-c but no change in TC and TG when comparing the baseline results and the results obtained after three months of DMPA use.[37] Similarly, a study conducted among Nepalese women indicated that after two years of DMPA use, there was a highly significant increase in TC and LDL-c, with no significant changes observed in TG and HDL-C. The discordance observed in the findings could be attributed to contextual factors such as different follow-up periods, diet, and physical activities since these can mediate the potential effects of DMPA on the user's body.[38]

The present study further reveals the effect of DMPA usage on blood glucose variations since the median of %HBA1c increased significantly over 12 months of follow-up. The significant increase in median %HbA1c found in this study concurs with findings from an experimental study done in Indonesia.[20] The effect of progesterone on hepatic glucose production and insulin resistance could explain these changes in blood glucose during DMPA use.[32, 33] During the pre-menopausal period, the synergic effect of Progesterone and estrogen regulates glucose metabolism, ensuring optimal glucose homeostasis. These synergic effects may be dysregulated in women on DMPA contraception. It has been previously reported that oestrogen increases the production and enhances insulin sensitivity.[34,35] Therefore, the use of hormonal contraceptives creates dysregulation of these sex hormones due to the additional excessive hormones that possibly impact metabolism.

Strengths and limitations of the study

This study is among the few studies that assessed the changes in cardiometabolic risk markers among abdominally obese women using DMPA. Therefore, it provides essential baseline information that could potentially guide scientists to develop studies in this area to fully understand the necessity of prior screening for potential cardiometabolic risk parameters before initiating this contraception method and instituting routine follow-up of users to mitigate the risk of cardiometabolic disease. This study was a pre-post study with a prospective approach where data were collected at three points, and trends were observed and compared at each time point.

However, the study encountered some limitations, among them the self-report on the use of hormonal contraceptives and the duration of the previous use, which could introduce some bias in the results. Another important limitation of this study is the absence of a comparison group consisting of abdominally obese women using alternative non-hormonal contraception methods.

The lack of a control group restricts our ability to draw definitive conclusions about the synergic effects of DMPA and central obesity on cardiometabolic health. Another limitation is the failure to control participants' lifestyles during the follow-up period, which could influence some of the factors investigated in the study. Further study that considers all those factors includes all types of hormonal contraceptives used in Rwanda, and extends the follow-up period would be appreciated. Even though we have noted these limitations, we are still confident that our findings are very informative and provide guidance for further studies.

Conclusion and recommendations

The dropout rate in this study was minimal to affect our findings as the sample size was estimated considering the potential impact of dropout. The study concludes significant changes in cardiometabolic risk markers over 12 months of DMPA use in abdominally obese women, particularly HDL-c, TG, blood pressure, HbA1c, and hs-CRP, all of which are recognized risk factors of CVDs type two diabetes. Therefore, it is essential to screen for central obesity before initiating DMPA, even in normal-weight women, as normal-weight central obesity is common, especially in African women. It is also recommended that health providers conduct routine follow-ups with DMPA users to enable the identification of potential cardiometabolic risk markers as early as possible and counter any possible development of the cardiometabolic disease.

Authors' contribution

EK conceived the idea, and designed the study methodology. She carried out the literature review, data collection, and wrote the first draft. DU worked on data analysis and critically revised the manuscript. AU supervised all research activities. All authors read and revised the manuscript and agreed on the final version before submission.

Conflict of interest

No conflicts of interest are associated with this study

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