

Overview of acupuncture as an adjunct to *in-vitro* fertilization treatment in black african women: a preliminary study

Abstract

Introduction: Acupuncture, an ancient Chinese medical art of relieving pain and treating other ailments, is currently applied as an adjuvant in Assisted Reproduction Therapy, but its use in the management of infertility is still in embryonic stage in Africa.

Objective: To document preliminary findings on the use of acupuncture adjuvant among women undergoing In-vitro Fertilization in Nigeria.

Materials and methods: All women who had adjunct acupuncture between August 2016 and July 2017 at Nordica Fertility Center were included in the study. These included 110 infertile females some of who were accompanied by their spouses while others came alone. Acupuncture was adjunct to IVF treatment types such as “own egg”, “recipient”, “surrogacy” and “Frozen Embryo Transfer” (FET). After all the acupuncture sessions had been done and at the completion of treatment (IVF), each woman had pregnancy test to confirm fecundity. The acupuncture points used were in conformity with international standards.

Results: A total of 110 infertile women were recruited into the study. The means (\pm sd) of their age, Body Mass Index and years trying to conceive were 36.9 (6.4) years, 29.8 (6.3) Kg/m² and 6.8 (5.5) years respectively. In all, 21 (19.1%) came with their spouse, 71 (64.6%) were nulliparous, 58 (52.7%) had undergone failed IVF treatment elsewhere and 19 (17.3%) had previously undergone acupuncture at Nordica fertility Center. Those who had 1-3 acupuncture sessions were 1.33 times more likely to have a positive PT than those who had >3 acupuncture sessions ($\chi^2=0.36$, P-value=0.55, OR=1.33, 95% CI:0.53, 3.36). Normal weight women who had 1-3 acupuncture sessions were 5 times likely to have positive PT than those who had >3 acupuncture sessions ($\chi^2=1.80$, P-value=0.18, OR=5.00, 95% CI:0.81, 31.00). Overweight women who had 1-3 sessions were about equally as likely to have positive PT s those who had >3 sessions ($\chi^2=0.00$, P-value=1.00, OR=1.08, 95% CI:0.21, 5.49) while obese women who had 1-3 sessions were not likely to have positive PT as those who had >3 sessions ($\chi^2=0.08$, P-value=0.77, OR=0.54, 95% CI:0.10, 3.08).

Conclusion: Infertile women who were overweight or obese required more acupuncture sessions with IVF to have positive PT while infertile women with normal BMI required lesser acupuncture sessions to produce a positive PT result.

Keywords: adjuvant acupuncture, black africa, infertility, IVF, Nigeria

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Introduction

Acupuncture originated in China over 2000 years ago, as a technique for curing diseases, alleviating pain and promoting healing by inserting fine needles into some specific points of the body surface. Acupuncture is a combination of the Latin word, acus meaning “needle”, and the English word puncture. It is said that the word acupuncture was coined way back in the 17th century.¹ This method of healing was based on the Chinese knowledge of energy channels, known as meridians, which run like rivers in regular patterns through the body and over its surface to irrigate and to nourish the body tissues.² Thus, obstruction in the flow of these rivers of energy is likened to a dam that backs up causing illnesses and pain. The American Pregnancy Association claims that acupuncture plays a positive role in addressing complications of infertility such as hypo-, or hyperthyroidism.³

In 1997, Chen B⁴ described the use of acupuncture in correcting dysfunctional hypothalamic-pituitary-ovarian axis. Thus, the use

of acupuncture in the management of infertility began, stimulating interests in the use of this method as an adjuvant in assisted reproduction therapy. About 5 years after, a group of German scientists evaluated how acupuncture influences pregnancy rate in assisted reproduction therapy (ART) and documented clinical pregnancy in 42.5% of their cases and only 26.3% in the control group.⁵ When the same group conducted another study using placebo acupuncture, they obtained a higher pregnancy rate (37.0%) than what they obtained with the control group in their earlier study.⁶ In an earlier paper, Manheimer et al.⁷ suggested that adjunct acupuncture with embryo transfer improves rates of pregnancy and live birth among women undergoing in vitro fertilization. However, in a later meta-analysis of sixteen trials, including 4021 participants, he and his colleagues⁸ reported no pooled benefit of adjuvant acupuncture for IVF. Interestingly, several studies have been conducted which demonstrated higher pregnancy rates in women who received acupuncture as an adjunct to IVF,⁹⁻¹¹ even in sham acupuncture procedures.^{9,10}

It is widely known that, notwithstanding numerous new technological advances, the success rate of IVF could be better, with approximately 30% of treatment cycles resulting in a live birth in the USA.¹² Thus, the surge in use of acupuncture as an adjuvant to IVF might have arisen due to the need for novel laboratory techniques to escalate success rates of IVF apart from increasing the number of embryos transferred.⁸ Studies have shown acupuncture to be the most widely used adjuvant complementary and alternative medical (CAM) fertility treatment among couples seeking fertility care in US fertility clinics.^{13,14} Use of adjuvant acupuncture in Assisted Reproduction Therapy among Black African women is unknown. Recently, the Global Acupuncture Project organized a Pan African Acupuncture Project in Uganda mainly to train healthcare workers in utilizing simple and effective acupuncture techniques in the management of HIV/AIDS, malaria, and TB.¹⁵ In some private health facilities in South Africa, acupuncture is also employed in the management of arthritis, body pain, back pain, knee pain, foot pain, sciatica.¹⁶ However, there is hardly any study on adjuvant acupuncture in the management of infertility in Africa. This paper seeks to fill that gap and report the outcome of adjuvant acupuncture among black African women seeking ART in Nigeria.

Materials and methods

This was a prospective, all-inclusive study, carried out on all female patients who had acupuncture while undergoing IVF treatment at Nordica Fertility Center from August 1, 2016 to July 31, 2017. Each client read through and appended her signature on the consent form before commencing the acupuncture sessions and IVF treatments. During the review of the hormonal tests and SFA for pre-IVF assessment, consultants brought up the option of adjunct acupuncture therapy in the management of the patients' infertility. Inclusion criteria for study participants were: (i) pre-IVF assessment (ii) absence of any health conditions that would be worsened by hormonal drugs for infertility management (iii) must have given consent. Exclusion criteria were: did not give consent. A Consultant Gynecologist took all relevant history from each woman such as age, occupation, marital status, years trying to conceive, type of infertility, parity and medical history of hypertension, diabetes mellitus and asthma. Patients were also asked if they have had IVF or acupuncture before and where they had such services. The cause of each patient's infertility was determined from laboratory reports. All women that had adjunct acupuncture between August 2016 and July 2017 at Nordica Fertility Center were included in the study. These were 110 infertile females some of who were accompanied by their spouses while others came alone. Acupuncture was adjunct to IVF treatment types such as "own egg", "recipient", "surrogacy" and "Frozen Embryo Transfer" (FET). After all the acupuncture sessions had been done and at the completion of treatment (IVF), each woman had pregnancy test to confirm pregnancy. The Consultant Gynecologists, the Embryologists and all the Nursing staff were blinded to who did or who did not receive adjunct acupuncture and the acupuncturist was equally blind to those who received or did not receive IVF treatment. The acupuncturist in this study (ISE) has a wealth of experience, having been trained in China amongst top acupuncturists in that country and her needling points are consistent with the international standards. The acupuncture points used were in conformity with the German protocol. On the day of embryo transfer, 2 sessions were done, each lasting thirty minutes. Before embryo transfer, the following Acupoints were used: PC6 (Neiguan), SP8 (Diji), LR3 (Taichong), GV20 (Baihui), and ST29 (Guilai). After embryo transfer, the following Acupoints

were used: ST36 (Zusanli), SP6 (Sanyinjiao), SP10 (Xuehai), and LI4 (Hegu). Additional AcuPoints were: Auricular acupuncture at the following points, without rotation: ear point 55 (Shenmen), ear point 58 (Zhigong), ear point 22 (Neifenmi), and ear point 34 (Naodian). Two needles were inserted in the right ear, the other two needles in the left ear. The four needles remained in the ears for 25 minutes. The side of the auricular acupuncture was changed after embryo transfer.

Data management and statistical analysis

Age was segregated into <35 and ≥35 years and BMI was divided into underweight (BMI<18.5), normal (BMI 18.5-24.9), overweight (BMI 25.0-29.9) and obese (BMI≥30.0). Sessions of acupuncture were divided into two groups – 1-3 sessions and >3 sessions. Data was entered into each patient's medical record and transcribed into Excel spreadsheet in a laptop, coded, cleaned and exported to STATA 13 (StataCorp, College Station, Texas, USA) statistical software for analysis. Frequency tables were constructed for variables that were categorical. Cross-tabulations, Student's t-test and χ^2 (Chi-square) analysis with Odds ratio and 95% Confidence Interval were employed where appropriate. Significance was considered at a P-value of <0.05. The resulting data were illustrated as Tables and figures

Results

A total of 109 consecutive infertile women were included in the study, all of whom signed the inform consent form, a must for every patient who presents for IVF and all procedures at Nordica fertility Center. Means (\pm sd) of age, BMI and years trying to conceive (TTC) were 36.9 (6.4) years, 29.9 (6.2) Kg/m² and 6.8 (5.5) years respectively. Majority of the patients (75, 68.8%) were aged ≥35 years, with a mean (\pm sd) age of 40.2 (4.5); were obese (46, 41.8%) with a mean (\pm sd) BMI of 35.7 (4.7) and have been trying to conceive for 2-5 years (56, 51.4%) with a mean of 3.5 (1.2) years. Those who had female cause of their infertility (44, 40.0%) have been trying to conceive for a mean (\pm sd) of 6.6 (4.9) years but those who had combined cause of their infertility (42, 38.2%) had a significantly longer ($t=-2.07$; P-value=0.021) mean (\pm sd) TTC of 9.1 (6.2). Further, majority (70, 64.2%) of these patients were nulliparous. (Table 1)

Among the patients, 21 (19.1%) came with their spouse, 71 (64.6%) were nulliparous, 58 (52.7%) had undergone IVF treatment elsewhere while only 19 (17.3%) had undergone acupuncture previously at Nordica fertility Center. In all, 75 (68.2%) of the patients used own egg as for treatment while 33 (30.0%) were recipients. Only one woman each (0.9%) presented for Frozen Embryo Transfer (FET) and for Surrogacy. (Table 2)

Pregnancy Test (PT) was positive in 26 women among who 10 (38.5%) had 1-3 acupuncture sessions and 16 (61.5%) had >3 sessions; negative in 76 patients of who 24 (31.6%) had 1-3 and 52 (63.4%) had >3 acupuncture sessions. "Others" refer to the remaining 8 women among whom PT was not done for 1 who had 1-3 acupuncture sessions and was cancelled in another woman who also had 1-3 sessions; there was no fertilization among 2 women who had >3 acupuncture sessions; and there was no cleavage in 2 women who had 1-3 sessions and in another 2 women who had >3 sessions. There was no significant difference in the proportion of PT-positive women who had 1-3 sessions of acupuncture ($\chi^2=0.41$, P-value=0.52, OR=1.35, 95% CI:0.54, 3.42) compared to those who had >3 sessions. Patients who had 1-3 sessions of acupuncture were approximately 1.4 times more likely to have positive PT compared to those who had >3 acupuncture sessions. (Figure 1)

Table 3 presents the overall outcome of PT by type of treatment taking into consideration age, BMI and the number of acupunctures sessions the patients had. The only infertile woman who had a BMI of <18.5 Kg/m² was excluded from further analysis. Among the 25 (22.9%) women with normal BMI (18.5-24.9 Kg/m²), 9 (36.0%) and 16 (64.0%) had 1-3 sessions and >3 of acupuncture respectively. In all, 9 (8.3%) normal BMI, 15 (13.8%) overweight and 14 (12.8%) obese patients had 1-3 sessions of acupuncture of whom 5 (55.6%) 2 (13.3%) and 2 (1.3%) had positive pregnancy tests. On the other hand, 4 (25.0%) normal BMI, 5 (21.7%) overweight and 7 (21.9%) obese patients had more than 3 acupuncture sessions with positive pregnancy test results.

Considering the 25 patients with normal BMI, 9 (47.4%) of the 19 patients who used “own egg” treatment became PT-positive among whom 5 (55.6%) were aged <35 years (2 [40.0%] had 1-3 acupuncture sessions and 3 [75.0%] had >3 acupuncture sessions). The remaining 4 (44.4%) who used own egg treatment were aged ≥35 years among whom 3 (33.3%) had 1-3 acupuncture sessions and 1 (25.0%) had >3 acupuncture sessions. Five (20.0%) of the 25 patients with normal BMI used “recipient treatment” but all, aged ≥35 years, had negative PT results. Only patient (12.5%), aged ≥35 years, had other type of treatment and was PT-positive.

The Table also shows that of the 38 overweight patients, 26 (68.4%) use “own egg” treatment, only 4 (15.4%) had PT-positive results, all aged <35 years; one (6.7%) among the 15 (39.5%) who had 1-3 sessions of acupuncture and the other 3 (13.0%) among the 23 (60.5%) that had >3 sessions of acupuncture. Of the 8 patients who used “recipient treatment”, only 3 were PT-positive – 1 (6.7%) among the 15 (39.5%) who had 1-3 sessions of acupuncture and 2 (8.7%) among the 23 (60.5%) that had >3 sessions of acupuncture. The remaining 2 patients, aged ≥35 years, who had other type of treatment with 1-3 sessions of acupuncture were PT negative.

There were 46 (42.2%) obese women 14 (30.4%) of whom had 1-3 sessions of acupuncture and 32 (69.6%) had >3 sessions. Of these 46, 22 (47.8%) had “own egg” treatment. Of the 14 who had 1-3 sessions of acupuncture with “own egg” treatment, 1 (7.13%) was PT-positive; other patients, one aged ≥35 years, who had “recipient treatment” and the other, aged <35 years who had other type of treatment were also PT-positive.

Overall, infertile women with normal BMI who had 1-3 sessions of acupuncture were 5 times as likely to have positive PT compares to their counterparts who had >3 sessions of acupuncture (Fisher’s $\chi^2=1.80$, P-value=0.18, OR=5.00, 95% CI:0.81, 31.00). Likewise, overweight infertile women who had 1-3 sessions of acupuncture were about 1.08 times as likely to have positive PT results as their counterparts who had >3 sessions of acupuncture (Fisher’s $\chi^2=0.00$, P-value=1.00, OR=1.08, 95% CI:0.21, 5.49). Obese infertile women who had 1-3 sessions of acupuncture were not likely to have positive PT results compared to their counterparts who had >3 acupuncture sessions (Fisher’s $\chi^2=0.08$, P-value=0.77, OR=0.54, 95% CI:0.10, 3.08).

Whereas infertile women with normal BMI, who had “own egg” treatment with 1-3 sessions of acupuncture, were 5 times more likely to have positive PT compared to their counterpart who has >3 sessions of acupuncture (Fisher’s $\chi^2=1.27$, P-value=0.26, OR=5.00, 95% CI:0.65, 38.15), overweight infertile women who had “own egg” treatment with >3 acupuncture sessions were those 1.4 times likely to have positive PT compared to those who had 1-3 acupuncture sessions

(Fisher’s $\chi^2=0.00$, P-value=1.00, OR=1.40, 95% CI:0.12, 15.97) and obese infertile women who had “own egg” treatment with 1-3 acupuncture sessions were 1.08 times as likely to have positive PT compared to their counterparts who had >3 sessions (Fisher’s $\chi^2=0.00$, P-value=1.00, OR=1.08, 95% CI:0.08, 14.41) (Data not shown).

Table 4 and Figure 2A & 2B illustrate the outcome of pregnancy by parity after 1-3 or >3 sessions of adjunct acupuncture. Of the 38 (34.9%) patients who had 1-3 acupuncture sessions, 5 (13.2%) had singleton pregnancy of whom 3 (60.0%) were nulliparous, 1 (20.0%) was of parity 1 and another 1 (20.0%) of parity 2. There were 3 (7.9%) twin pregnancy among whom were 2 (66.7%) nulliparous women and 1 (33.3%) of parity 1. The only woman who had ectopic pregnancy was nulliparous, the only woman who had missed abortion was also nulliparous. Of the remaining 71 (65.1%) patients who had >3 acupuncture sessions, 10 (13.9%) had singleton pregnancy of whom 7 (70.0%) were nulliparous and 3 (30.0%) were para 1. Only 2 (2.8%) had twin pregnancy and both were nulliparous. The only woman who had a missed abortion was nulliparous. In all, the results of the PT conducted on 25 (31.2%) of those who had 1-3 acupuncture sessions and on 55 (68.8%) of those who had >3 acupuncture sessions were negative.

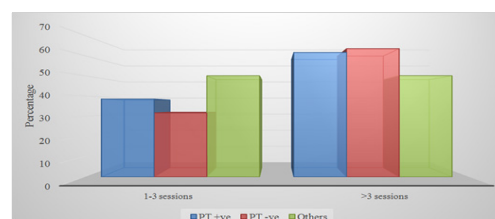


Figure 1 Result of pregnancy tests relative to acupuncture sessions attended.

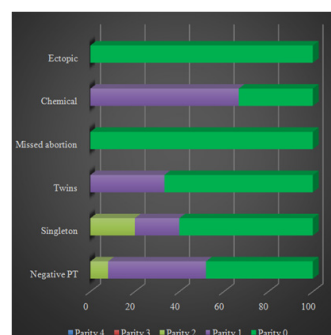


Figure 2A Outcome of pregnancy by parity after 1-3 acupuncture sessions.

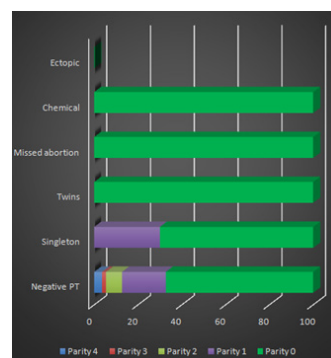


Figure 2B Outcome of pregnancy by parity after >3 acupuncture sessions.

Table 1 Socio-demographic and gynecologic characteristics of study subjects

Variable	Sub-variable	Total	%	Mean	±sd
Age		109	100	36.9	6.4
Age group	<35	34	31.2	29.7	3.4
	≥35	75	68.8	40.2	4.5
BMI		109	100	29.9	6.2
BMI group	18.5-24.9	25	22.7	22.8	1.3
	25.0-29.9	38	34.5	27.6	1.4
	≥30	46	41.8	35.7	4.7
Years trying to conceive (TTC)		109	100	6.8	5.5
TTC group	≤1	9	8.3	0.8	0.3
	2-5	56	51.4	3.5	1.2
	6-9	14	12.8	6.7	0.8
	≥10	30	27.5	14.8	3.6
		Female	44	40	6.6*
Cause of infertility	Male	18	16.5	2.9	1.5
	Combined	42	38.2	9.1*	6.2
	Others	5	4.5	3.2	5
	0	70	64.2	0	0
Parity	1	29	26.4	1	0
	2	7	6.4	2	0
	3	1	0.9	3	0
	4	2	1.8	4	0

*t, -2.07; P-value, 0.021

Table 2 Frequency distribution of causes of infertility by some variables

Variable	Item	Cause of infertility					Total
		Female	Male	Combined	Others		
Came with spouse	Yes	Freq.	12	0	8	1	21
		%	27.3	0	19	20	19.1
	No	Freq.	32	18	34	4	88
		%	72.7	100	81	80	80.9
	Total	Freq.	44	18	42	5	109
		%	40	17.3	38.2	4.5	100
Parity	0	Freq.	26	11	32	1	70
		%	59.1	61.1	76.2	20	64.2
	1-2	Freq.	17	7	10	2	36
		%	38.6	38.9	23.8	40	33
	>2	Freq.	1	0	0	2	3
		%	2.3	0	0	40	2.8
Previous IVF elsewhere	Yes	Freq.	20	11	23	4	58
		%	45.4	61.1	54.8	80	53.2
	No	Freq.	24	7	19	1	51
		%	54.6	38.9	45.2	20	46.8

Table Continued

Previous acupuncture in this facility	Yes	Freq.	8	2	9	0	19
		%	18.2	11.1	21.4	0	17.4
	No	Freq.	36	16	33	5	90
		%	81.8	88.9	78.6	100	82.6
Own egg		Freq.	27	18	26	3	74
		%	61.4	100	61.9	60	67.9
Recipient		Freq.	15	0	16	2	33
		%	34.1	0	38.1	40	30.3
Surrogacy		Freq.	1	0	0	0	1
		%	2.3	0	0	0	0.9
Frozen Embryo Transfer		Freq.	1	0	0	0	1
		%	23	0	0	0	0.9

Table 3 Overall outcome of pregnancy test relative to sessions of acupuncture among patients who used own egg, recipient, surrogacy or FET for IVF.

Treatment type	Pregnancy Test (PT)	Age group (yrs.)	BMI 18.5-24.9 (n=25; 22.9%)				BMI 25-29.9 (n=38, 34.9%)				BMI ≥30 (n=46, 42.2%)				Total	
			Acupuncture sessions		Acupuncture sessions		Acupuncture sessions		Acupuncture sessions		Acupuncture sessions		Acupuncture sessions		%	
			1-3 (n=9, 36.0%)	>3 (n=16, 64.0%)	1-3 (n=15, 39.5%)	>3 (n=23, 60.5%)	1-3 (n=14, 30.4%)	>3 (n=32, 69.6%)	1-3 (n=14, 30.4%)	>3 (n=32, 69.6%)	1-3 (n=14, 30.4%)	>3 (n=32, 69.6%)				
			Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
All	Total		9	8.3	16	14.7	15	13.8	23	21.1	14	12.8	32	29.4	109	100
	Positive PT		5	55.6	4	25	2	13.3	5	21.7	2	14.3	7	21.9	26	23.9
	Negative PT		3	33.3	12	75	11	73.4	18	78.3	11	78.6	21	65.6	75	68.8
	Others		1	11.1	0	0	2	13.3	0	0	1	7.1	4	12.5	8	7.3
χ^2 (P-value)			1.80 (0.18)				0.00 (1.00)				0.08 (0.77)					
Odds ratio (95% CI)			5.00 (0.81, 31.00)				1.08 (0.21, 5.49)				0.54 (0.10, 3.08)					
Own egg	+ve	All	5	55.6	4	25	1	6.7	3	13	1	7.1	2	6.2	16	23.9
		<35	2	40	3	75	1	100	3	100	1	100	0	0	10	62.5
		≥35	3	60	1	25	0	0	0	0	0	0	2	100	6	37.5
Own egg	-ve	All	2	22.2	8	50	7	46.7	15	65.3	6	42.9	13	40.6	51	76.1
		<35	1	50	5	62.5	5	71.4	6	40	2	33.3	4	30.8	23	45.1
		≥35	1	50	3	37.5	2	28.6	9	60	4	66.7	9	69.2	28	54.9
Recipient	+ve	All	0	0	0	0	1	6.7	2	8.7	1	11.1	5	55.6	9	29
		<35	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		≥35	0	0	0	0	1	100	2	100	1	100	5	100	9	100
Recipient	-ve	All	1	12.5	4	13	2	13.3	3	13	5	21.7	8	34.8	22	71
		<35	0	0	0	0	0	0	0	0	0	0	0	0	2	9.1
		≥35	1	100	4	100	2	100	3	100	5	100	8	100	20	90.9

Table Continued

Others	+ve	All	1	12.5	0	0	0	0	0	0	1	11.1	4	12.5	6	5.5	
		<35	0	0	0	0	0	0	0	0	1	100	0	0	1	16.7	
		≥35	1	100	0	0	0	0	0	0	0	0	4	100	5	83.3	
	-ve	All	0	0	0	0	2	8.7	0	0	0	0	0	0	0	2	6.2
		<35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		≥35	0	0	0	0	2	100	0	0	0	0	0	0	0	2	100

Table 4 Frequency distribution of outcome of pregnancy by parity and by acupuncture sessions

Parity	Acupuncture sessions	Outcome of pregnancy												Total	%
		PT Negative, no sac or not done		Singleton		Twins		Missed abortion		Chemical		Ectopic			
		Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%		
0	1-3	12	48	3	60	2	66.7	1	100	1	33.3	1	100	20	52.6
1		11	44	1	20	1	33.3	0	0	2	66.7	0	0	15	39.5
2		2	8	1	20	0	0	0	0	0	0	0	0	3	7.9
3		0	0	0	0	0	0	0	0	0	0	0	0	0	0
4		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		25	31.2	5	13.2	3	7.9	1	2.6	3	5.3	1	2.6	38	34.9
0	>3	37	67.3	7	70	2	100	1	100	3	100	0	0	51	70.8
1		11	20	3	30	0	0	0	0	0	0	0	0	14	19.4
2		4	7.3	0	0	0	0	0	0	0	0	0	0	4	5.6
3		1	1.8	0	0	0	0	0	0	0	0	0	0	1	1.4
4		2	3.6	0	0	0	0	0	0	0	0	0	0	2	2.8
Total		55	68.8	10	13.9	2	2.8	1	1.4	3	1.4	0	0	71	65.1

Discussion

Almost all studies on adjuvant acupuncture in IVF are conducted in developed countries. Therefore, data from this study have no comparison on the African continent or among Blacks anywhere else, making this the first study to report on adjuvant acupuncture in the management of infertility among Black African women. There are some key points that need to be addressed in this paper. The first is that the mean age of the women in this study was 36.9 years, similar to the mean ages of the subject in other studies^{14,17} but slightly higher than the 32.1 years that Paulus reported.⁵ It should also be added that the mean age of all the patients was about 37 years, a reflection of the age at which women generally present for infertility management in Nigeria as reported in a previous study¹⁸ In addition, most of the patients were obese with a mean BMI of 35.7 Kg/m². No study has reported acupuncture specifically in overweight or in obese women before. It is known that fertility is compromised in overweight or obese patients and many may opt for any technology that may increase their chance of getting pregnant. Furthermore, although most of the patients in this study have been trying to conceive for 2-5 years, the mean duration of TTC for 30 of the patients was 14.8 years, indicating that these women may be desperate to get pregnant and thus decided to try adjuvant acupuncture with their IVF to enhance their chances of getting pregnant. This may be corroborated with the finding that about 53% of the patients had IVF before and these were probably not successful. Also, female factor as cause of infertility was seen more among our patients than combined or male factor infertility. This accords with what Leke¹⁹ presented at the W.H.O, AFRO, EMRO Regional Management of Infertility Workshop.

Many randomized, controlled, prospective studies reported higher pregnancy rates among women who had adjunct acupuncture with IVF compared to controls.^{5,9-11} As far as is known, this is the first study of adjuvant acupuncture and IVF in Black Africa. It might also be the first to determine the result of pregnancy test relative to acupuncture sessions, synergy of Age and BMI, Own egg treatment and recipient treatment. This study noticed, as a key finding, that the odds of getting pregnant was higher among infertile women who had 1-3 acupuncture sessions than among those who had more than 3 acupuncture sessions. In line with our findings, a meta-analysis study suggested that acupuncture given with embryo transfer improves rates of pregnancy and live birth among women undergoing *in-vitro* fertilization.⁷ Another interesting major finding was that there appeared to be a separate and a synergistic effect of age and BMI on the results of pregnancy test after acupuncture sessions and IVF, a phenomenon that has not been considered before. In this study, women with normal BMI were more likely to produce positive pregnancy test after 1-3 acupuncture sessions than those who were overweight or obese. Taken the other way, it seemed that overweight and obese women require more acupuncture sessions to produce positive PT than women with normal BMI. Age and BMI in synergy appeared to be a decisive factor as older obese women who had more than 3 sessions of acupuncture became pregnant whereas with 1-3 sessions, very few overweight or obese infertile woman over 35 years of age produced positive PT. Hoffman et al.²⁰ proposed that acupuncture needles stimulate muscle afferents innervating ergoreceptors, which leads to increased β-endorphin concentration in the cerebrospinal fluid.²⁰ Anderson et al. contend that the hypothalamic β-endorphinergic system has inhibitory

effects on the vasomotor center, thereby reducing sympathetic activity and that this central mechanism, involving the hypothalamic and brainstem systems, controls many major organ systems in the body.²¹ Furthermore, Chen and Yu contend that acupuncture may also regulate the function of the hypothalamic-pituitary-ovarian axis via the central sympathetic system by changing the concentration of central opioids.²² The mechanism by which overweight and obese women require more acupuncture for a successful IVF is not certain. However, it might be related to the hormonal system and blocked energy that needs release by more acupuncture sessions. This is an important future research subject. The last major finding in this study was that the outcome of pregnancy favored nulliparous and women with parity of 1 more than multiparous women, regardless of the number of acupuncture sessions given. This could be due to uterine factor.

The study population who had acupuncture sessions were more likely to be those who had female factor of infertility involved more than male factor infertility, probably because they wanted to correct any issue that may have been impeding their chances of getting pregnant and have a family. Regardless of type of treatment (own or recipient), this study observed that more sessions of acupuncture (>3) proved advantageous to overweight, obese and women aged 35 years and above. This may be because they were poor responders to IVF and poor responders have been shown to require more acupuncture sessions.²³

Study limitations

This study has certain limitations which need to be discussed. Firstly, the small sample size might have limited the robustness of the study because of segregation into different ages and different BMIs. There might have been a bias in sample selection. Also, only one woman had a BMI of <18.5 Kg/m² and in most of the analysis she was excluded. It would have been very interesting to know the effect of adjuvant acupuncture across all the BMI groups for a better comparison. However, there were enough infertile women with normal, overweight and obese BMI for the study. Secondly, unlike many other studies, this study did not include a placebo, a sham acupuncture or control group. It just reported what was observed at Nordica Fertility Center.

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Conflict of interest

Authors declare that there is no conflict of interest.

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