ANTHROPOMETRIC PROFILE OF WOMEN ON HORMONAL CONTRACEPTIVES IN UNIVERSITY OF PORT HARCOURT TEACHING HOSPITAL (UPTH)

ABSTRACT

Background: Contraception is essential in population control, determining the number and spacing of children. The use of contraceptives has been on the rise because people do not always have sex for the purpose of procreation. Women of childbearing age prefer hormonal contraceptives, because they are highly effective and their effects are reversible. The aim of the study was to determine the anthropometric profile of women on hormonal contraceptives.

Materials and Methods: The study included women on hormonal contraceptives from University of Port Harcourt Teaching Hospital (family planning clinic) and those who do not use contraceptives, from University of Port Harcourt Post Graduate School. A total of two hundred (200) volunteers were involved in the study; 100 women on hormonal contraceptives and 100 women who were not under any form of hormonal contraceptive (as control) were randomly selected. Height was measured using a stadiometer and stature meter, weight, body mass index (BMI), skeletal muscle mass and body fat percentage was measured using body composition monitor. Mid arm, waist, hip and neck circumference was measured using a measuring tape, while skin fold thickness was measured using a skin fold caliper. Data analysis was done using Microsoft Excel Data Analysis Tool pack (2019 Edition) and Statistical Package for the Social Sciences (SPSS version 23.0). T-test was done to determine differences in anthropometric parameters for those on contraceptives and the control, and type of contraceptive (implants and injectables). Age related differences and duration of contraception was determined using ANOVA at $P < 0.05$.

Results: Except for skeletal muscle mass, women on hormonal contraceptives have higher but non-significant mean values for all anthropometric parameters compared to the control. Age related differences were not observed for the three (3) age categories involved in the study (20 – 29 years; 30 – 39 years; ≥ 40 years). Type of contraceptive (implants and injectables) also do not have any significant effect on the anthropometric parameters of the study group and the control. Gradual increase in measured parameters were observed over time, but no significant difference was observed over the period of five (5) years as categorized (< 1 year, 1 - 2 years, 3 - 4 years and ≥ 5 years).

Conclusion: The findings made in this study will be relevant to gynecologists, family physicians and medical anthropologists.

Keywords: Contraceptive, hormone, implant, injectable, anthropometry

1. INTRODUCTION

Contraception (birth control) refers to the intentional prevention of conception (pregnancy after sexual intercourse) through the use of various methods and sexual practices. Prior to sexual intercourse, contraception is said to occur when the production of ova is hindered intentionally. During or after intercourse, it tries to stop the sperm from reaching the ovum. It also stops fertilized ovum from attaching to the lining of the uterus. As a result, any device or act whose purpose is to prevent pregnancy is considered a contraceptive. [1, 2, 3]

Methods of contraception includes: hormonal methods [Combined hormones (oral pills, patches, vaginal rings) Progestin only (Depo-Provera, progestin-only pill, implants)], barrier methods which could be chemical (spermicides) or physical (use of condoms, diaphragm and cervical cap), surgical methods (vasectomy, tubal ligation and intrauterine devices), while natural methods include withdrawal before ejaculation i.e. coitus interruptus, avoiding sex on a woman's fertile days, abstinence etc. [4, 5, 6]

The effectiveness of a method is primarily considered when making a choice of contraceptive.
An effective contraception allows sexual intercourse without fear of unwanted pregnancy and allows a couple the freedom to have children when desired.
The least effective methods of contraception include the use of spermicides (chemicals), and coitus interruptus. This is followed by hormone-based methods (which are only reliable if properly used), while sterilization is the most effective, but usually an irreversible method.
Hormone-based methods are preferable, because they are reversible and much easier to manage. As a result, more women go for hormonal contraceptives when compared to other methods. [7, 8]

Historically, studies have shown that out all the reasons for having sex (such as pleasure, stress relief, exercise, sexual curiosity, or attraction to a person), having a baby is the least frequent motivator. [9, 10]
This is one of the reasons contraceptives are on high demand leading to the speedy search for more effective forms. However, studies on the effects of each method and procedure on the body using anthropometry has been limited. Although past studies and research on the side effects of hormonal contraceptives were focused on the physiologic, pharmacokinetics and pharmacodynamics points of view without much emphasis on the anthropometric profile of these women.
These reasons made the conduct of this research on clinical anthropometry of women on hormonal contraceptives (using body mass index, skeletal muscle mass, body fat percentage, waist to hip ratio, mid arm circumference, waist circumference, hip circumference, neck circumference and skin fold thickness) necessary.

2. MATERIALS AND METHODS

2.1 Study Design

This was a comparative study designed to compare women on hormonal and those who are not on contraceptives.

2.2 Study Population

The study population includes women on hormonal contraceptives from University of Port Harcourt Teaching Hospital (family planning clinic) and those who are not on contraceptives, which includes staff and students of University of Port Harcourt Post Graduate School.

2.3 Sampling Technique and Sample Size

Purposive (selective) sampling technique was used for data collection and a total number of 200 volunteers were involved in the study; 100 women on hormonal contraceptives and 100 women who are not on any form of hormonal contraceptive were randomly selected.

2.4 Source of Data

The study involved primary data, collected from volunteers at the Post-graduate School of University of Port-Harcourt and University of Port-Harcourt Teaching Hospital.

2.5 Method of Data Collection/Procedure

The purpose of the study was made known to the participants and they were assured that anonymity will be maintained after which an informed consent form was given to them to sign. Questionnaires were distributed to those who gave their consent. Biodata, type of hormonal contraceptive and measurements taken were recorded on the questionnaire.

The following measurements were taken; height, body mass index, skeletal muscle mass, body fat percentage, waist to hip ratio, mid arm circumference, waist circumference, hip circumference, neck circumference and skin fold thickness. Measurements were taken by three individuals to minimize inter-rater variability. And all measurements were taken three times and the average recorded.

2.5.1 Determination of Height

Height was measured in centimeter (cm) using collapsible stadiometer and stature meter, with the participant standing barefooted on the base of the stadiometer. The pternion (the most posterior part of the calcaneus) was placed close to the base of the stadiometer after which, the stature meter was dragged to the level of the vertex (Figure 1A).

2.5.2 Determination of Skinfold Thickness

The skin of the right triceps was pinched to raise a double layer of skin and the underlying adipose tissue. Skinfold thickness was measured in millimeters (mm) using a digital skinfold caliper, placed 1 cm below and at right angles to the pinch (Figure 1B).

2.5.3 Determination of Waist, Hip, Neck and Mid-Arm Circumference

Waist and Hip circumference were measured in millimeter (mm) using a measuring tape. The waist measurement was taken at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest. These measurements were taken at the end of normal respiration. Hip circumference was taken at the widest portion of the buttocks, while neck and mid-arm circumference was taken at the neck and mid-arm respectively.

Waist-Hip ratio was calculated using the following mathematical expression;

$WHR = \frac{Waist\ Circumference}{Hip\ Circumference}$, where WHR = Waist Hip Ratio.

2.5.4 Determination of Body Mass Index, Skeletal Muscle Mass and Body Fat Percentage

The parameters mentioned above were measured using a body composition monitor (Omron Body Composition Monitor BF511) [Figure 1C], a machine that accurately analyzes human body composition (body mass index, body fat percentage, skeletal muscle mass, visceral fat) through multi-frequency biochemical impedance analysis (Figure 1D). Height, age and sex of the participants were first entered into the hand-held monitor screen of the machine, before the participants were then requested to step on the weighing scale part of the machine barefooted having laid off their shoes, thick clothing and socks.

After weight determination, the participants were requested to pick up the hand-held monitor screen at 90°; this allows the sensor to correctly read, analyze and interpret data. The results displayed on the screen were recorded. Bosy-Westphal *et al* [11] certified this instrument capable to monitor and analyze body composition.

Figure 1A: Measuring Height with a Stadiometer and Stature Meter

Figure 1B: Measuring Skin fold thickness

Figure 1C: Body composition monitor

Figure 1D: A subject using a body composition monitor

2.5.5 Selection Criteria

The following subjects were included in the study;

1. Individuals within the age of 18-45 years.
2. Individuals that are not on any form of contraceptive (as control).
3. Individuals on hormonal contraceptives for at least 3 months.
4. Individuals not on any form of weight reduction program**.**
5. Individuals not suffering from any immune or chronic health conditions like Cancer, HIV/AIDS, Diabetes, Heart Disease, Hepatitis, Sickle Cell Anemia, Tuberculosis, Hypertension, etc.
6. Participants must be female staffs and students from the University of Port-Harcourt and women from University of Port Harcourt Teaching Hospital.

2.6 Data Analysis

Data was analyzed using Statistical Package for the Social Sciences (SPSS) version 23.0. and Microsoft Excel Data Analysis Tool pack (2019 Edition). Results were presented in descriptive statistics (mean±standard deviation) and percentage distribution.

Independent sample t-test (unpaired) was used to test for significant difference in the mean values of the measured anthropometric variables of women on hormonal contraceptives and the control group, as well as type of contraceptives (injectables and implants). Analysis of variance (ANOVA) was used to compare the measured anthropometric variables according to age groups and duration of contraception in order to ascertain the influence age and time respectively.
Confidence interval was set at 95%; hence, $P < 0.05$ was considered statistically significant.

3. RESULTS

The study examined the clinical anthropometry of women on hormonal contraceptives. The effect of hormonal contraceptives on anthropometric parameters such as body mass index, body fat percentage, skeletal muscle mass, waist-circumference, hip-circumference, waist-hip ratio, and mid arm circumference was evaluated. Two groups of women of the same age category were involved in the study; those who have been on hormonal contraceptives for at least 3 months and those who are not on any form of hormonal contraception.

3.1 Anthropometric assessment

The descriptive statistics of the measured anthropometric parameters for all participants is presented in Table 1. Significant difference was not observed between the anthropometric parameters of women on hormonal contraceptives (WOHC) and the control group at $P < 0.05$. Except for skeletal muscle mass [26.52±3.17 (WOHC); 26.97±3.16 (control)], higher mean values were observed in all measured parameters for the contraceptive group compared to the control. Body mass index [26.06±4.56 (WOHC); 25.35±5.46 (control)], body fat percentage [36.94±8.06 (WOHC); 35.81±8.83 (control], mid-arm circumference [31.6±9.66 (WOHC); 29.97±4.48 (control)], neck circumference [33.51±9.31 (WOHC); 32.99±2.71 (control)], hip circumference [106.27±9.62 (WOHC); 103.53±11.93 (control)], waist circumference

[88.73±12.75 (WOHC); 86.07±15.81 (control)], waist hip ratio [0.83±0.07 (WOHC); 0.82±0.09 (control)] and skinfold thickness [26.74±3.89 (WOHC); 26.16±4.68 (control)].

3.2 Influence of age

Age related differences in the anthropometric parameters of women on hormonal contraceptives is presented in Table 2. The participants were divided into three (3) categories (20 – 29, 30 – 39 and ≥ 40). Age was shown to have no significant influence (at $P < 0.05$) on the anthropometric parameters of women on hormonal contraceptives.

3.3 Type of contraceptive

Independent sample T-test was used in Table 3 to determine the differences in the anthropometric parameters according to the type of contraceptive (injectables and implants). Except skeletal muscle mass [26.38±3.31 (injectable); 26.59±3.12 (implant)], mid-arm circumference [31.53±3.60 (injectable); 31.63±11.41 (implant)] and neck circumference [32.61±3.49 (injectable); 33.91±10.97 (implant)], all other anthropometric parameters were observed to be higher for those on injectables compared to implants. Significant difference was observed in hip circumference ($T = 2.24$; $P = 0.03$) between those on injectables and those on implants.

3.4 Duration of contraception

Differences in anthropometric parameters according to duration of contraception was determined in Table 4 using analysis of variance. For a period of less than a year to 5 years and above (< 1 year, 1 - 2 years, 3 - 4 years and ≥ 5 years), no significant difference (at $P < 0.05$) was observed in the anthropometric characteristics of women on hormonal contraceptives.

4. DISCUSSION

Use of contraceptives and weight gain has been a subject of discuss for a long time. [7] In this study, weight gain was observed for women on hormonal contraceptives as higher mean values in BMI, body fat percentage, mid arm circumference, neck circumference, waist hip ratio and skin fold thickness were observed. This agrees with the findings of Lopez *et al* [7], Spevack [12], Trussell *et al* [13] on progestin-only contraceptives, long term implication of depo provera and a study on obesity and oral contraceptive pill failure respectively. These authors observed that women on hormonal contraceptives experienced weight gain. Contraceptives (especially

combined contraceptives) are said to cause weight gain due to very high levels of estrogen and progestin, especially in the early 1960s when birth control pills were first approved and sold. [8, 14, 15] Current hormonal contraceptives have reduced amounts of estrogen and progestin. [8, 14, 15] This may account for the little, but no significant increase in the BMI and body fat percentage of the contraceptive group compared to the control. Hormonal contraceptives are said to contribute to weight gain due to fluid retention, increased appetite and body fat. [14] These effects are said to be dose dependent or linked to somatotype and genetic makeup of the individual. This is because, some women on hormonal contraceptives have reported weight loss, while some others did not. [14, 15]

The effect of hormonal contraceptives on the anthropometric profile of a woman is independent of her age. As observed in this study, age has no significant effect on the anthropometric characteristics of women on hormonal contraceptives.

Different age categories have slightly higher mean values for certain anthropometric parameters. Generally, an increase decrease increase pattern was observed in the anthropometric parameters (BMI, mid-arm circumference, neck circumference, hip circumference, waist circumference, skin fold thickness) of women on hormonal contraceptives across three (3) age categories.

Higher mean values were observed for weight, BMI, body fat percentage, waist circumference, waist hip ratio and skin fold thickness for women on hormonal contraceptives ($\geq$ 40 years), while skeletal muscle mass, mid arm circumference, neck circumference, waist circumference were higher for women on hormonal contraceptives between the age of 20 – 29 years. According to Johnson [14]; Gallo *et al* [15]; Yancey, and Raleigh [16], women tend to gain weight as they age irrespective of contraceptive use. The combined effect of age and contraceptive use justifies the increase in selected anthropometric (weight, BMI, body fat percentage, waist circumference and skinfold thickness) parameters for women greater than or equal to 40 years. Studies on hormonal contraceptives mostly consider the effects on selected parameters, but they were not grouped by age. [17, 18]

Except hip circumference, the nature and type of contraceptive (injectables and implants) used had no significant effect on the anthropometric parameters of women on hormonal contraceptives. Body weight and all other obesity indicators (BMI, hip circumference, waist circumference and waist hip ratio) had higher mean values for those on injectables compared to

implants. This shows that women on injectables would likely gain weight compared to those on implants. Shiferaw *et al* [17] made similar observations, in a study comparing women on injectables such as depo-medroxyprogesterone acetate (DMPA) and those on implants. They compared the effects of both contraceptives on the following anthropometric indices; weight, BMI, hip circumference, waist circumference and observed higher mean values for those on injectables. As earlier mentioned, higher levels of estrogen and progestin, could lead to weight gain. [8, 14, 15] Therefore it is not surprising that those on injectables gain more weight compared to those on implants. Let's analyze a typical injectable [depo-medroxyprogesterone acetate (DMPA)] and an implant (Implanon/Nexplanon) considering the progestin content. DMPA contains substantially higher amounts of estrogen and progestin. [12] A 90-day dosage of DMPA amounts to 150 mg, which is significantly higher than the 90-day dosages of the progestin only Implanon/Nexplanon (etonogestrel implant) (6.3 mg). [12] Etonogestrel is released at the rate of 60-70µg/day, and in 90 days 6,300µg (6.3mg) would have been released. The plasma levels of these hormones could be responsible for the observed differences.

The measured anthropometric characteristics of women on hormonal contraceptives, were generally observed to increase as the stay longer on contraceptives i.e. there is a time dependent increase. Those on contraceptives for less than a year, has lesser mean values, which generally increases with time. While those on hormonal contraceptives for 5 years and above have the highest mean value for most of the measured parameters (BMI, body fat percentage, hip and waist circumference etc. which are obesity indicators). Studies have shown that some women do gain a little bit of weight when they start using contraceptives, and this is considered a temporary side effect as the body do adjust to it over time. [14]. This accounts for the slight decrease in hip and waist circumference after 1 - 2 years, which was observed to increase later with longer duration.

Use of contraceptives for longer durations may affect anthropometric profile, especially increase in hip circumference, waist circumference and BMI.

5. CONCLUSION

The study evaluated the anthropometric characteristics of women on hormonal contraceptives and those on no form of contraceptive from the University of Port Harcourt teaching hospital and the post graduate school respectively.

Anthropometric characteristics as observed in the present study shows no significant difference between those on hormonal contraceptives and the control group. Weight gain, increase in body fat percentage and skin fold thickness were also observed for those on hormonal contraceptives.

There were no age-related differences in measured anthropometric parameters. And also type of contraceptive and how long an individual has been on contraceptive was observed to have no significant effect on the anthropometric characteristics of that individual. Gradual increase over time was observed especially for BMI and waist hip ratio.

The findings made in this study will be relevant to gynecologists, family physicians in the management of women on hormonal contraceptives.

TABLES

Table 1: Descriptive statistics of the anthropometric parameters of all participants

Parameters	WOHC [N = 100]	Control [N = 100]	*T*-test	
			***T*-value**	***P*-value**
Height (cm)	165.22±6.23	165.81±6.03	-0.67	0.50
Weight (kg)	71.49±13.20	69.79±16.05	0.82	0.41
Body Mass Index (kg/m^2)	26.06±4.56	25.35±5.46	1.00	0.32
Body Fat percentage (%)	36.94±8.06	35.81±8.83	0.94	0.35
Skeletal Muscle Mass (%)	26.52±3.17	26.97±3.16	-1.01	0.31
Mid Arm Circumference (cm)	31.6±9.66	29.97±4.48	1.53	0.13
Neck Circumference (cm)	33.51±9.31	32.99±2.71	0.54	0.59
Hip Circumference (cm)	106.27±9.62	103.53±11.93	1.79	0.08
Waist Circumference (cm)	88.73±12.75	86.07±15.81	1.31	0.19
Waist Hip Ratio	0.83±0.07	0.82±0.09	1.06	0.29
Skin Fold Thickness (mm)	26.74±3.89	26.16±4.68	0.95	0.34

***WOHC** = Women on hormonal contraceptives*

Table 2: Age related differences in Anthropometric parameters of women on hormonal contraceptives

Parameters	Age in years			ANOVA	
	20 – 29 [N = 16]	30 – 39 [N = 58]	≥ 40 [N = 26]	*F-value*	*P-value*
Height (cm)	164.36±8.21	165.91±6.14	164.22±4.95	0.85	0.43
Weight (kg)	70.46±18.98	70.59±11.98	74.15±11.68	0.71	0.49
Body Mass Index (kg/m^2)	26.06±6.39	25.45±4.15	27.40±4.00	1.66	0.20
Body Fat percentage (%)	35.61±9.03	36.35±7.85	39.09±7.81	1.31	0.28
Skeletal Muscle Mass (%)	26.89±2.97	26.60±3.12	26.11±3.44	0.35	0.71
Mid Arm Circumference (cm)	35.63±22.89	30.02±3.72	32.66±2.57	2.39	0.10
Neck Circumference (cm)	37.11±22.59	32.27±2.91	34.06±2.38	1.78	0.17
Hip Circumference (cm)	108.74±12.82	105.12±9.13	107.30±8.35	1.09	0.34
Waist Circumference (cm)	90.01±16.89	87.04±12.49	91.69±9.99	1.30	0.28
Waist Hip Ratio	0.82±0.07	0.82±0.07	0.85±0.05	2.13	0.12
Skin Fold Thickness (mm)	27.14±4.11	25.99±3.75	28.15±3.79	3.00	0.05

ANOVA *= Analysis of Variance*

Table 3: Type of contraceptive and anthropometric parameters of women on hormonal contraceptives

Parameters	Injectable [N = 31]	Implants [N = 69]	*T*-test	
			***T*-test**	***P*-value**
Height (cm)	166.94±6.61	164.46±5.93	1.87	0.07
Weight (kg)	75.34±14.10	69.77±12.49	1.98	0.05
Body Mass Index (kg/m^2)	26.82±4.80	25.72±4.45	1.11	0.27
Body Fat percentage (%)	37.37±8.26	36.75±8.02	0.36	0.72
Skeletal Muscle Mass (%)	26.38±3.31	26.59±3.12	-0.30	0.76
Mid Arm Circumference (cm)	31.53±3.60	31.63±11.41	-0.05	0.96
Neck Circumference (cm)	32.61±3.49	33.91±10.97	-0.65	0.52
Hip Circumference (cm)	109.41±9.53	104.86±9.39	2.24	**0.03***
Waist Circumference (cm)	92.34±11.56	87.10±13.00	1.93	0.06
Waist Hip Ratio	0.84±0.06	0.82±0.07	0.91	0.37
Skin Fold Thickness (mm)	26.79±4.11	26.71±3.82	0.09	0.93

Table 4: Duration of contraception and anthropometric parameters of women on hormonal contraceptives

Parameters	< 1 year	1 - 2 years	3 - 4 years	5 and above	ANOVA	
					F-value	*P*-value
H (cm)	165.35±6.26	164.48±60	165.79±5.90	166±7.02	0.33	0.80
W (kg)	69.59±11.61	71.36±12.96	72.11±14.88	73.59±12.38	0.37	0.78
BMI (kg/m^2)	25.23±4.85	26.09±4.68	26.41±4.27	26.76±4.34	0.32	0.81
BF (%)	35.74±8.55	37.21±7.96	36.84±6.36	37.96±8.90	0.32	0.81
SMM (%)	26.56±2.98	26.37±3.16	26.71±1.93	26.61±4.09	0.05	0.99
MAC (cm)	29.85±4.10	33.37±14.89	29.19±3.22	32.15±3.12	1.02	0.39
NC (cm)	32.12±3.12	34.81±14.62	32.25±3.72	33.71±2.33	0.52	0.67
HC (cm)	106.32±8.37	105.5±11.67	105.51±8.81	108.02±7.75	0.35	0.79
WC (cm)	88.37±12.85	87.59±15.10	88.04±9.35	91.55±10.13	0.47	0.70
WHR	0.82±0.07	0.82±0.07	0.83±0.05	0.84±0.05	0.57	0.64
SFT (mm)	26.18±3.82	27.39±4.10	25.75±2.81	26.88±4.21	0.84	0.48

***H** = Height, **W** = Weight, **BMI** = Body Mass Index, **BF** = Body Fat Percentage, **SMM** = Skeletal Muscle Mass, **MAC** = Mid Arm Circumference, **NC** = Neck Circumference, **HC** = Hip Circumference, **WC** = Waist Circumference, **WHR** = Waist Hip Ratio, **SFT** = Skin Fold Thickness*

6. COMPETING INTERESTS DISCLAIMER

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly used products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

Consent

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

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