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Are contraceptive methods associated with obesity? A comparative study between hormonal vs non-hormonal methods in Ecuadorian women

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Abstract

Background: *Excess body weight (overweight and obesity) currently represents one of the most important public health challenges worldwide, due to its magnitude, rapid increase and negative effect on health. One of the great myths surrounding hormonal contraception is the possibility of weight gain in users, which negatively affects adherence to treatment. Despite the discomfort caused, there are cases of abandonment, but there are also those women who continue it, so as not to bring a new being without being planned, but in the long run, it would be harmful for these women, since they could develop diseases such as overweight or obesity, diabetes, hypertension and cardiovascular problems.*

Materials and Methods: *We used a nationally representative sample of 18,532 women of childbearing age older than 15 years from the National Health and Nutrition Survey (ENSANUT, 2018). We used heteroscedasticity and autocorrelation tests of the data to rule out possible statistical modeling problems and used multicollinearity tests to avoid redundant information in the models. We also calculated confusion matrices to test the correct specification of the models. In addition, we used a binary logistic linear regression model where Odds Ratio (OR) with their 95% confidence intervals (95% CI) were estimated for each of the independent variables.*

Results: *Our results show that women using hormonal contraceptive methods are more likely to suffer from obesity compared to those using non-hormonal contraceptive methods. Specifically, we found that the correlation coefficients and Od ratios are significant and positive in women who reported using hormonal contraceptive methods, while we found no significant coefficients in women using non-hormonal contraceptive methods. We found that other control variables in the model such as age, income, employment, schooling, residential area and ethnicity have an impact on women's obesity.*

Conclusion: *Within the range of hormonal contraceptives used for contraception, there is much speculation about their possible connection with weight change. Considering that many women nowadays are users of oral contraceptives, patches, implants and injections, and weight change is a big problem for them. In our study, it was found that there is no association between the use of non-hormonal methods and obesity in women of childbearing age ($p>0.05$). The use of emergency oral contraception is a factor significantly associated with obesity in women of childbearing age. The results of this study should be disseminated, since in our country there were no studies confirming that obesity is associated with the use of hormonal contraceptives. Regardless of women's body weight, contraceptive methods represent a barrier to unwanted pregnancies. Progestin-only*

contraceptives and intrauterine devices cause minimal metabolic effects and are as effective in most overweight and obese women.

***Key Word**: Obesity, Women, Contraceptive Methods, Reproductive Rights*

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I. Introduction

Excess body weight (overweight and obesity) currently represents one of the most important public health challenges worldwide due to its magnitude, rapid increase and negative effect on health. [1]It is a major risk factor for non-communicable diseases, which are the most important morbidity and mortality burden in the world. An elevated BMI is associated with metabolic problems, such as insulin resistance, increased cholesterol, triglycerides, cardiovascular problems, such as coronary heart disease and stroke.[2].

Birth control has been a constant concern since the dawn of mankind, so human beings have made numerous efforts in the search for methods that allow women to think and live motherhood not as their destiny, but as their choice. Today it is completely evident that the health and quality of life of people improve when they have the ability to decide the number of children and space pregnancies. Therefore, based on a deep human and social sense, the need arose to provide the population of childbearing age with a way to control their fertility, which led to the creation of family planning and contraception, aimed at achieving these objectives.[3].

On the other hand, family planning is a transcendental component of reproductive health whose practice underlies the conscious and responsible exercise of the couple's right to decide the number of children they want and the spacing between them, in addition to promoting maternal and child health and responsible parenthood.[4]. This is why, of the one billion women of reproductive age worldwide, more than half use some form of contraception.[5]. Between 2000 and 2019, the prevalence of modern contraceptive use among married women of reproductive age increased globally by 2.1 percentage points: from 55.0% (95% CI: 53.7% to 56.3%) to 57.1% (95% CI: 54.6% to 59.5%).Reasons for this slow increase include the limited availability of methods; limited access to family planning services, especially among young, poorer, and unmarried people; fear of adverse reactions, sometimes experienced previously; opposition for cultural or religious reasons; poor quality of available services; user and professional bias against some methods; and gender-based barriers to accessing services.[6].

Despite the fact that contraceptive methods are widely used, the side effects they produce are not few and it has been concluded that the occurrence of these side effects depends on many factors such as the type of hormonal contraceptive, the dosage of estrogen in them, the presence of associated diseases, the mode of use and other factors associated with the method user.[3]. In the routine gynecological care of patients requesting hormonal contraception, one of their most recurrent questions is what will be the impact on their body weight. The answer is usually that weight gain may be zero or a few kilograms, depending on the type of hormonal contraceptive, its components and doses, as well as the patient's own willpower to control the possible increase in appetite that these steroidal hormone preparations may generate. On the other hand, the use of hormonal contraception is usually stimulated by its high efficacy and other non-contraceptive benefits, or motivating its use by remembering that in a few months a pregnancy modifies the weight in a much more significant amount, which does not leave room for further hesitation, generally.[7].

Research related to weight variation and body mass index in hormonal contraceptive users has shown that weight change is the second most frequent effect of subdermal implants, practically all studies show weight gain. A small number of patients loss or gain a few pounds of weight when they start taking the pills, these changes are much smaller when the tablets contain low amounts of hormones, the weight usually stabilizes after the first few cycles.[8]. Different authors have pointed out that most users showed an increase between 0.4-1.5 kg per year, up to 2.5 kg in Chinese women and 2.6-3.3 kg in American adolescent women. When comparing Implanon with Norplant, a weight gain of 20.7 and 10% has been reported, respectively. Among the causes of weight gain, the following have been proposed: the androgenic effect of the progestin in use, fluid retention (which is unlikely) and the last one, a change in basal metabolism. Causes that are not very different from what happens with other contraceptive methods.[9]. In turn, the use of hormonal contraceptives has generated greater attention due to the changes observed in body weight where weight gains of up to 5.1 kg in a period of 36 months have been observed, which is associated with desertion of the method; however, the evidence is controversial to assert the relationship between hormonal contraceptives with weight gain. Therefore, the present article aims to review the current evidence on the metabolic effects and weight change of hormonal contraceptive use in women of childbearing age.[10]. Santos P. et al. in their study Energy expenditure and anthropometric measures of new users of quarterly injectable contraceptives medroxyprogesterone acetate depot in Brazil 2015; evaluated two groups, 28 users of medroxyprogesterone acetate (DMPA) and 24 users of copper intrauterine devices (IUD), they obtained the following results, the mean BMI was 23.9 kg/m2 in the DMPA

group and 24.5 kg/m2 for the IUD group, DMPA users had gained 2.2 kg of weight and - 0.2 kg in the IUD group

Therefore, as can be seen in most of the studies conducted on contraceptive methods, few studies have managed to study the relationship between the use of hormonal contraceptives and their involvement in body weight variation. Although the information is still insufficient to demonstrate reliably that there is a causal relationship between the use of hormonal contraceptives and weight gain, this study seeks to study this relationship so that health personnel can provide sufficient information to users so that they do not abandon treatment due to a false perception.

II. Material And Methods

Study Design and Population: An ecological, cross-sectional study was conducted with data obtained from the National Health and Nutrition Survey of Ecuador (ENSANUT) of 2018, whose data were obtained and presented by the National Institute of Statistics and Census (INEC). After cleaning the database, a total of 18532 Ecuadorian women of childbearing age, currently using contraceptives between hormonal and non-hormonal, were obtained.

Inclusion and Exclusion Criteria: Data from women over 15 years of age who were currently using a contraceptive method were included.

Source of Information: The ENSANUT 2018 is a survey included in the National Statistical Program that employs probability sampling applied every 5 years and whose target population is all household members in the 24 provinces of Ecuador. The ENSANUT 2018 includes the form HOGAR where all the characteristics of the Ecuadorian population are evidenced to make representative estimates at the national level, urban-rural, by geographic domain for the 24 provinces of the country. In addition, the anthropometric measurements of women currently using contraceptive methods can also be found.

Study Variables. Our dependent variable is obesity and our independent variable is the use of family planning contraceptive methods. The information for these variables was obtained through the calculation made from the data provided in the Women of childbearing age form.

Statistical Analysis. The ENSANUT 2018 survey database was analyzed with the statistical package Stata v15 (Stata Corporation, College Station, Texas, USA). A value of $p<0.05$ was considered to determine statistical significance between variables. The Chi-square test was used to determine the overall correlation between the variables of interest. The association was evaluated by prevalence ratios with their respective 95% confidence intervals with an analysis for each of the variables included in the study, the independent variable of interest being the sociodemographic conditions of each participant.

The obesity variable was created from the body mass index (BMI). Traditional literature points out that adult individuals with a BMI≥30 are considered obese. Therefore, from the BMI we created a dichotomous variable that takes the value of 1 if BMI≥30 and takes the value of 0 if BMI<30. In addition, the contraceptive methods variable (hormonal or non-hormonal) is a dichotomous variable that is coded from the question What was the last contraceptive method you or your partner used? Therefore, we first code with 1 all women who answered that they used a hormonal method and 0 otherwise, then we do the same, but code with 1 all women who answered that they used a non-hormonal method and 0 otherwise.

In order to estimate the relationship between obesity and hormonal and non-hormonal contraceptive methods we used a discrete choice probit model:

$$Obesity_i = \beta_0 + \beta_1 hormonal\ methods_i + \sum_{j=2}^{12} \beta_j Z_i + \varepsilon_i \quad (1).$$

Where $Obesity_i$ represents obesity (measured by a dichotomous variable that takes a value of 1 if a woman is obese and 0 if she is not), $hormonal\ methods_i$ represents a variable denoting the use of hormonal contraceptive methods, and represents a set of individual and territorial control variables. $Z_i$represents a set of individual and territorial control variables.

$$Obesity_i = \beta_0 + \beta_1 Non-hormonal\ methods_i + \sum_{j=2}^{12} \beta_j Z_i + \varepsilon_i \quad (2).$$

Where $Obesity_i$ represents obesity (measured by a dichotomous variable that takes a value of 1 if a woman is obese and 0 if she is not), $Non-hormonal\ methods_i$ represents a variable denoting the use of non-hormonal contraceptive methods, and represents a set of individual and territorial control variables. Z_i represents a set of individual and territorial control variables.

Ethical considerations. The present study did not require the approval of an institutional ethics committee for its execution, since it is an analysis of data freely available to the public and it was not necessary to use informed consent.

III. Result

Table 1 presents the descriptive statistics of the variables used in this study. Here we observe that 23.68% (with a CI 22.33-23.55) of women present obesity, while 76.83% do not present obesity (i.e. they have a BMI<30). On the other hand, we observed that 64.57% of women use hormonal contraceptive methods, compared to 35.43% of women who use non-hormonal contraceptive methods. We also observed that the average labor income of the women is $432 USD, 42.7% of the women are from the highland's region, the average age is 28.34 years old and 81.03% of the women are mestizo. In addition, 40.7% of the women are single and 38.1% are married. We also observed that 43.4% of the women have a high school education and 64.57% of the women are employed. Likewise, we observed that 7.1% of the women reported that they engage in physical exercise. Regarding territorial characteristics, we observed that on average there are 151 inhabitants per square kilometer, the provincial gross value added (economic development) is on average $1297.65 USD and 59.33% of the women live in the urban area.

Table 1. Descriptive statistics of the variables used in this study.

Variable	Mean-Percent	Min	Max	95% CI
Obesity				
No Obesity	76.83%	0	1	76.05-77.66
Obesity	23.68%	0	1	22.33-23.55
Contraceptive methods				
Hormonal methods	64.57%	0	1	17.97-19.12
Non-hormonal methods	35.43%	0	1	80.05-82,66
Labor income				
Income in dollars	432.12	0	1876	423.27 -445.45
Region of origin				
Sierra	38.5%	0	1	38-39
Costa	42.7%	0	1	41.21-43.09
Amazon	16.3%	0	1	15.98-17.01
Galapagos	2%	0	1	1.96-2.51
Age				
Age in years	28.34	14	41	24.12-32.54
Ethnicity				
Indigenous	7.1%	0	1	6.6-7.28
Afro-Ecuadorian	5.3%	0	1	4.90-5.98
Mongrel	81.03%	0	1	80.22-81.86
White	1.4%	0	1	1.2-1.9
Montubio or Others	4.6%	0	1	4-5.1
Marital status				
Married	38.1%	0	1	38-39
Single	40.7%	0	1	41.21-43.09
Widow	18.3%	0	1	15.98-19.01
Divorced	2.35%	0	1	1.96-2.51
Educational level				
None	0.7%	0	1	0.3-1.1
Basic Education	27.3%	0	1	27.1-28.3
Middle/High School Education	43.4%	0	1	43.41-44.12
Higher Education	27.1%	0	1	26.87-27.98

Employment status				
Employee	64.57%	0	1	17.97-19.12
Unemployed	35.43%	0	1	80.05-82,66
Physical exercise				
Performs physical exercise	7.1%	0	1	6.6-7.28
Urban density				
Inhabitants per square kilometer	151.01	1152.5	321	146.32-160.33
Economic development of the province				
Provincial GVA per capita	1297.65	540.5	321	836.43-1456.67
Area				
Urbana	59.33%	0.54	0	55.51-61.51
Rural	44.49%	0.36	0	41.49-46.49

Table 2 presents a cross-tabulation to look at the percentage of obese and non-obese women using hormonal and non-hormonal methods of contraception. This table further unravels an interesting pattern. For example, we observe that there is a higher percentage of women using hormonal contraceptive methods who are obese, specifically we observe that 64.14% of women are obese versus 35.86% of women who are not obese. While 13.25% of women who use non-hormonal contraceptive methods are obese and 86.75% of these same women who use non-hormonal contraceptives are not obese. In general, we observed that there is a higher prevalence of obesity in women using hormonal contraceptive methods.

Table 2. Cross-tabulation between type of contraceptive method and obesity

Type of contraceptive method	Obesity	Non-obesity
Hormonal contraceptive method	64.14%	35.86%
Non-hormonal contraceptive method	13.25%	86.75%

Next, we performed a formal test to rule out the presence of multicollinearity among our independent variables. In **Table 3** we present a multicollinearity analysis. We use the Variance Inflator Factor (VIF) to perform this test. Previous literature indicates that a VIF greater than 5 can demonstrate that there is multicollinearity in our data. As we can see, no variable presents a VIF greater than 5, therefore we discard multicollinearity problems in our independent variables. This analysis is important since multicollinearity problems cause instability of the parameters of a regression, incorrect signs and higher standard errors, which results in statistical insignificance of the parameters. In addition, we performed heteroscedasticity and autocorrelation tests to rule out problems in the modeling. The heteroscedasticity tests rule out heteroscedasticity in the models and the correlation graph test rules out the existence of autocorrelation in the model. The results of these tests are shown in the Annexes in **Table A1** and **Figure A1**.

Table 3. Multicollinearity test of the variables

Variable	VIF	SQRT VIF	Tolerance	R-Squared
Hormonal methods	1.37	3.81	0.9913	0.0023
Non-hormonal methods	1.33	1.86	0.6135	0.3355
Labor income	1.98	1.65	0.9863	0.0336
Region of origin	1.35	1.33	0.2331	0.1189
Age	1.98	1.65	0.9863	0.0336
Ethnicity	1.67	1.23	0.3313	0.1133
Marital status	1.33	1.85	0.6310	0.3690
Educational level	1.13	1.36	0.9136	0.0353
Employment status	1.33	1.64	0.8836	0.3353
Physical exercise	1.33	1.85	0.6310	0.3690
Urban density	1.57	1.85	0.6310	0.3690
Economic development of the province	1.44	1.75	0.9653	0.0353
Area	1.63	1.11	0.8865	0.3097
Mean VIF	1.92			

Then, the confusion matrix of the model is shown. In **Table 4** we can see that the models we estimated are correctly specified. In the first model we use hormonal contraceptive methods as the independent variable, which is 71.22% specified by the independent variables. That is, the independent variables predict obesity in 71.22% of the cases. Next, in the second model we use non-hormonal contraceptive methods as the independent variable, which is 80.42% specified by the independent variables. It is worth mentioning that this percentage is relatively high, being an acceptable level higher than 60%.

Table 4. Confusion matrix of the estimated models

Model of hormonal contraceptive methods			
	True		
Classified	D	~D	Total
	3281	1423	4736
	2451	2231	2718
Total	4288	2966	7254
Correctly classified			71.22%
Non-hormonal contraceptive methods model			
	True		
Classified	D	~D	Total
	3251	3463	5736
	2421	2344	2518
Total	4288	2966	7254
Correctly classified			80.42%

Next, to further explore the pattern found in **Table 2** we performed a linear regression analysis to observe and analyze the influence of contraceptive methods on obesity. For this we used a logit model as shown in **Table 5**. In the table, the dependent variable is the dichotomous variable of obesity which takes a value of 1 if a woman suffers from obesity (BMI≥30) and takes a value of 0 if a woman does not suffer from obesity (BMI<30). Here we observe that, as expected, the odd ratio (OR) is positive (greater than 1) and significant, showing us that women using hormonal contraceptive methods are 2 times more likely (OR=2.005, CI=1.981-2.055) to suffer from obesity compared to women using non-hormonal contraceptive methods. Other factors with negative odds ratios (negatively influencing obesity) are the woman's education, which increase as the mother's level of schooling increases, with a mother with higher education (OR= -2.783, CI= -2.042; -2.889) being the category with the highest magnitude. Another factor with a negative odds ratio is physical exercise, which presents an OR= -1.233 (CI= -1.058; -1.478). On the other hand, variables with positive odds ratios (which positively influence obesity) are labor income, living in the coastal region, being older, being of mixed race, living in an area with higher urban density and greater economic development.

Table 5. Logistic regression analysis between obesity and hormonal contraceptive methods**.**

	OR	P-value	95% CI
Var. dep.: Obesity =1, 0 otherwise			
Contraceptive methods			
Hormonal methods	2.005***	0.004	1.981-2.055
Labor income			
Income in dollars	1.078*	0.035	1.035-1.086
Region of origin			
Sierra	Ref.		
Costa	1.083*	0.030	1.010-1.369
Amazon	1.511	0.149	1.002-1.824
Galapagos	2.402	0.152	2.322-2.575
Age			
Age in years	0.822*	0.035	0.521-1.128
Ethnicity			
Indigenous	Ref.		
Afro-Ecuadorian	1.035	0.932	1.003-1.056
Mongrel	0.933**	0.006	0.626-2.086
White	0.903	0.864	0.276-1.071
Montubio or Others	0.818	0.620	0.692-0.991
Marital status			
Married	Ref.		
Single	-0.652*	0.050	-0.058--1.001

Widow	0.693	0.799	0.593-1.770
Divorced	0.976	0.981	0.083-2.034
Educational level			
None	Ref.		
Basic Education	2.262	0.125	2.221-2.860
Middle/High School Education	-2.337	0.109	-2.191--2.889
Higher Education	-2.783*	0.060	-2.042--2.889
Employment status			
Employee	Ref.		
Unemployed	1.099	0.634	1.0093-1.482
Physical exercise			
No	Ref.		
Yes	-1.233**	0.025	-1.058--1.478
Urban density			
Inhabitants per square kilometer	1.654**	0.023	1.570-7.242
Economic development of the province			
Provincial GVA per capita	1.092**		1.017-2.097
Area			
Urbana	Ref.		
Rural	-1.456	0.123	-1.570 - -1.242
Constant	5.790***	0.007	5.472-5.940
Observations	18532		
AIC	1848.35		
BIC	2011.41		
Chi^2	152.4		
Chi^2 *p-value*	0.000		
Log-likehood	-898.174		

Notes: Asterisks mean: *p <0.10,**p < 0.05, ***p < 0.01.

Next, to analyze the influence of non-hormonal contraceptive methods on obesity we used a logit model as shown in **Table 6**. In the table, the dependent variable is the dichotomous obesity variable that takes a value of 1 if a woman is obese (BMI≥30) and takes a value of 0 if a woman is not obese (BMI<30). Here we observe that, unlike what was found in the previous table, the use of non-hormonal contraceptive methods does not significantly influence obesity. This means that hormonal contraceptive methods significantly predict obesity compared to non-hormonal methods. This finding is interesting as we demonstrate that hormonal methods may be strongly correlated with obesity. Consistent with previous findings, other factors with negative odds ratios (negatively influencing obesity) are the woman's education, with a mother with higher education (OR= -2.783, CI= -2.042; -2.889) being the category with the highest magnitude. Another factor with a negative odds ratio is physical exercise, which presents an OR= -1.233 (CI= -1.058; -1.478). On the other hand, variables with positive odds ratios (which positively influence obesity) are labor income, living in the coastal region, being older, being of mixed race, living in an area with higher urban density and greater economic development.

Table 6. Logistic regression analysis between obesity and non-hormonal contraceptive methods.

	OR	P-value	95% CI
Var. dep.: Obesity =1, 0 otherwise			
Contraceptive methods			
Non-hormonal methods	1.001	0.004	1.981-2.055
Labor income			
Income in dollars	1.012**	0.015	1.005-1.086
Region of origin			
Sierra	Ref.		
Costa	1.083	0.590	1.010-1.369
Amazon	1.511**	0.049	1.002-1.824
Galapagos	2.402	0.152	2.322-2.575
Age			
Age in years	0.822*	0.035	0.521-1.128
Ethnicity			
Indigenous	Ref.		
Afro-Ecuadorian	1.035	0.932	1.003-1.056
Mongrel	0.933**	0.006	0.626-2.086
White	0.903	0.864	0.276-1.071
Montubio or Others	0.818	0.620	0.692-0.991
Marital status			
Married	Ref.		
Single	-0.652*	0.050	-0.058--1.001
Widow	0.693	0.799	0.593-1.770
Divorced	0.976	0.981	0.083-2.034
Educational level			
None	Ref.		
Basic Education	2.262	0.125	2.221-2.860

Middle/High School Education	-2.337	0.109	-2.191--2.889
Higher Education	-2.783*	0.060	-2.042--2.889
Employment status			
Employee	Ref.		
Unemployed	1.099	0.634	1.0093-1.482
Physical exercise			
No	Ref.		
Yes	-1.233	0.125	-1.058--1.478
Urban density			
Inhabitants per square kilometer	1.654**	0.023	1.570-7.242
Economic development of the province			
Provincial GVA per capita	1.092**		1.017-2.097
Area			
Urbana	Ref.		
Rural	-1.456	0.123	-1.570 - -1.242
Constant	5.790***	0.007	5.472-5.940
Observations	18532		
AIC	1848.35		
BIC	2011.41		
Chi^2	152.4		
Chi^2 *p-value*	0.000		
Log-likehood	-898.174		

Notes: Asterisks mean: *p <0.10,**p < 0.05, ***p < 0.01.

IV. Discussion

One of the great myths surrounding hormonal contraception is the possibility of weight gain in users, which negatively affects adherence to treatment. In the routine gynecological care of patients who request hormonal contraception, one of the most recurrent questions is what will be the repercussion on their body weight. The answer is usually that weight gain may be zero or a few kilograms, depending on the type of hormonal contraceptive, its components and dosage, as well as the patient's own willpower to control the possible increase in appetite that these steroid hormone preparations may generate.[11].

In our results we were able to observe that 23.68% (with a CI 22.33-23.55) of women present obesity, while 76.83% do not present obesity (i.e. they have a BMI<30). On the other hand, we observed that 64.57% of women use hormonal contraceptive methods, compared to 35.43% of women who use non-hormonal contraceptive methods. We also observed that the average labor income of the women is $432 USD, 42.7% of the women are from the highland's region, the average age is 28.34 years old and 81.03% of the women are of mixed race. In addition, 40.7% of the women are single and 38.1% are married. We also observed that 43.4% of the women have a high school education and 64.57% of the women are employed. Likewise, we observed that 7.1% of the women reported that they do physical exercise.

Among the results that most caught our attention is that we observed that there is a higher percentage of women who use hormonal contraceptive methods who suffer from obesity, specifically we observed that 64.14% of the women are obese compared to 35.86% of women who do not present obesity. While 13.25% of women who use non-hormonal contraceptive methods are obese and 86.75% of these same women who use non-hormonal contraceptives are not obese. In general, we observed that there is a higher prevalence of obesity in women using hormonal contraceptive methods. We also observed that, as expected, the odd ratio (OR) is positive (greater than 1) and significant, which shows us that women who use hormonal contraceptive methods are 2 times more likely (OR=2.005, CI=1.981-2.055) to have obesity compared to women who use non-hormonal contraceptive methods.

Our results are in agreement with those found in 2013, by Chero et al.[12]. Where they conducted a systematic review, with the aim of evaluating the association between combined contraceptives and weight variation. The first study, with six treatment cycles, compares the population administered Levonorgestrel 100 µg/Etinilestradiol 20 µg tablets with the placebo group and a mean weight change was observed with a mean difference of 0.3 (95% CI:-0.23-0.83), the mean weight change in the contraceptive group was 0.9, while the placebo group was 0.6; there being no significant differences in both groups. In the second study, with six treatment cycles, several comparisons were made, the first being the use of dimethisterone 25 mg/etinylestradiol 100 µg tablets with the placebo group and a weight gain of 2.3 kg mean difference of 1.02 (95% CI: 0.46 - 2.26) was observed. The second comparison was between ethinodiol diacetate 1mg/ mestranol 100 µg with placebo group and a mean difference 0.57 (95%CI: 0.24-1.33) was observed. For the third comparison between norethindrone 1mg/ mestranol 50µg versus placebo group, a mean difference 0.50 (95% CI: 0.22-1.17) was observed. In the third study, with a duration of 5 years, a comparison was made between 150 female athletes using norgestrel 300µg/ ethinylestradiol 30µg versus a group with no intervention and it was observed that there was a mean weight change per year with a mean difference -0.54 (96% CI: 1.39-0.31]. A significant weight gain was evident in almost all cases.[13].

Another study conducted on users of progestin-only contraceptives showed a greater increase in the percentage of body fat mass in users of pills with desogestrel (mean difference 3.30; 95% CI: 2.08 to 4.52)

compared to a group that did not use hormonal contraceptives. Another study was also able to report that at six months they found a greater weight gain (kg) for Norplant users (mean difference 0.47; 95% CI 0.29 to 0.65) versus no contraceptive use; this was confirmed in a following study a significant weight gain (kg) for Norplant users (mean difference 1.10; 95% CI 0.36 to 1.84) after one year of use. In addition, it was reported that in most of the studies the average weight gain was less than 2 kg up to one year; however, some of these studies showed a double weight gain by the second and fourth year.[14].

On the other hand, it has also been possible to document weight gain in users of the subdermal implant with etonorgestrel of approximately 4 kg during the three years of its permanence. This change is compared with that of women who do not receive hormonal methods.[15]. And among the most controversial studies it was found that the differences in average weight between depot medroxyprogesterone acetate versus copper IUD is 2.28 kg in the first year, 2.71 kg in the second year and 3.17 kg in the third year. A study that evaluated the efficacy of this contraceptive during 1 year postpartum reported an average weight gain of 1.5-3 kg, in addition to pointing out that overweight and obese patients, prior to pregnancy, are at greater risk of weight gain, so that other contraceptive options should be considered in women who wish to lose weight during this period.[16]. Therefore, in summary, it can be evidenced that in our study there is a statistically significant relationship between the use of hormonal contraceptive methods and obesity. Although it has been possible to determine this relationship in several studies, there is still insufficient information to demonstrate conclusively that there is a causal relationship between the use of hormonal contraceptives and weight gain, so it is important that health personnel should provide sufficient information to users so that they do not abandon the treatment due to a false perception.

V. Conclusion

In our results we observed that, as expected, the odd ratio (OR) is positive (greater than 1) and significant, showing that women who use hormonal contraceptive methods are 2 times more likely (OR=2.005, CI=1.981-2.055) to suffer from obesity compared to women who use non-hormonal contraceptive methods. Several studies have reported alterations in metabolic profile and weight gain with hormonal contraceptive use; however, many of the studies are difficult to interpret due to discontinuation and changes in contraceptive methods over time, as well as variability in study design, participant characteristics, and endpoints. Ultimately, there is no conclusive evidence of the metabolic effect or weight change of hormonal contraceptives, and the few changes reported in most studies have been considered clinically insignificant; however, it is important to keep this in mind in women with metabolic disorders or overweight prior to prescription.

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Annex

Table A1. Heteroscedasticity tests

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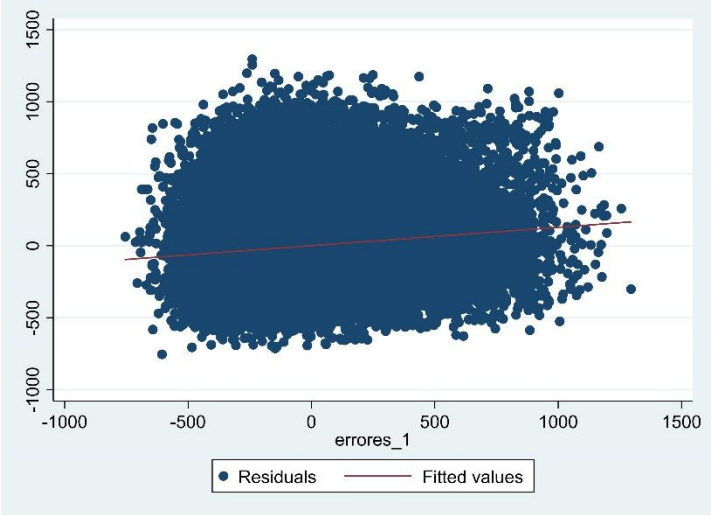
White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(8)      =   2603.27
         Prob > chi2  =    0.2000

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of ingrl

         chi2(1)      =  3494.42
         Prob > chi2  =   0.3000
```

Figure A1. Autocorrelation test



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