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Associations between the Type of Contraceptive Use with Nutritional Status and Macronutrient Intake among Women in Reproductive-Age in Tebet District

Hubungan Jenis Kontrasepsi dengan Status Gizi dan Asupan Makronutrien pada Wanita Usia Subur di Kecamatan Tebet

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ABSTRACT

Background: Female obesity prevalence was higher than male in 2018 at 44.4% and 26.6%, respectively, according to Badan Pusat Statistik (BPS). There is conflicting evidence on the effect of hormonal contraception on weight gain. While in Indonesia, hormonal contraception has been the most popular method.

Objectives: Examining the association between hormonal contraception usage, macronutrient consumption, and nutritional status.

Methods: This cross-sectional study involves 106 non-pregnant women aged 20-45 recruited using consecutive sampling methods. Respondents were grouped into hormonal and non-hormonal contraceptive users. Data analysis utilized chi-square, Fischer exact and multiple linear regression.

Results: More than half (59.5%) used hormonal contraception, while 40.5% used non-hormonal contraceptives. We found no significant correlation between hormonal contraception and Body Mass Index (BMI) (p-value=0.081), waist circumference (p-value=0.789), and macronutrient intake (p-value of energy=0.0675; protein=0.758; fat=0.156; carbohydrate=0.23). There was no significant relationship between the duration of contraceptive usage and BMI (p-value=0.163 and 0.248) or waist circumference (p-value=0.282 and 0.066) for either users or nonusers. Linear regression models showed that only fat and carbohydrate intake significantly contribute to waist circumference (The adjusted R2 of the model was 0.244, F 12.3, Sig.<0.001) and BMI (The adjusted R2 of the model was 0.206, F 7.8, Sig.<0.001).

Conclusions: There was a relationship between BMI, body fat percentage, junk food consumption pattern (type, frequency, amount of intake and fat), energy intake, fat intake, emotional overeating, diet attitude, and oral control of the abdominal circle. There was no significant relationship between fiber intake and abdominal circumference.

INTRODUCTION

The 2018 Basic Health Research (Riskesdas) data shows that in the adult population aged 18 years and over, the prevalence of overweight was 13.6%, and the prevalence of obesity was 21.8%[1]. Meanwhile, according to global data from the World Health Organization (WHO), more than 1.9 billion adults aged 18 years and over are overweight, and more than 650 million people are obese[2]. The prevalence of obesity in adult women is higher than in men both in the world and in Indonesia. According to data from the Central Statistics Agency (BPS) in 2018, obesity in women was 44%, while it was 26.6% in men. One of the factors that is hypothesized to be associated with obesity and overweight in women is drugs and hormones[3].

Hormonal contraception is still the main choice for most women in Indonesia—data from the 2021 National Socio-Economic Survey (Susenas) in Indonesian Youth Statistics from BPS. Most contraceptives used by women aged 16-30 years are injections at 64.49%; then birth control pills at 15.55%, followed by birth control implants at 8.85%, and IUD (Intra Uterine Device) at 7.08%[4]. The 2018 Riskesdas data also shows that the highest use of contraception is the 3-month injection at 42.4%, followed by birth control pills at 8.5%; Intra Uterine Device at 6.6%; 1-month injection at 6.1%, and implants at 4.7%. Contraception in the form of injections, pills and implants are hormonal contraceptives.

Previous studies found that the use of hormonal contraception affects the user's appetite, which leads to weight gain as well as an increase in Body Mass Index

(BMI) and increased obesity in Women of Childbearing Age[5,6,7,8]. Research in Yogyakarta, Indonesia, stated that the use of injectable hormonal contraceptives containing Depo-Medroxyprogesterone Acetate (DMPA) increases the risk of obesity by 2.53 times greater. The use of combination pills increases the risk of obesity by 3.17 times greater than nonusers. However, there were no significant differences in energy intake and expenditure between hormonal and non-hormonal contraceptive users[9]. These differences are related to the role of a combination of progestin and estrogen or only progestin on metabolism. Progestin, which is a synthetic form of progesterone and estrogen, influences the mechanism of energy intake and its expenditure. Progestin tends to increase energy intake, while estrogen shows the opposite effect[10].

Progestin reduces cholecystokinin (CCK) levels, whereas CCK reduces hunger and promotes carbohydrate metabolism into fat[8]. Thus, lower CCK leads to increased hunger cues. In addition, progestin also increases the expression of orexigenic proteins in the hypothalamus. Meanwhile, estrogen has the opposite effect of progestin. It inhibits the expression of orexigenic proteins, which increases the expression of anorexigenic proteins in the hypothalamus and increases the sensitivity of the hormones cholecystokinin (CCK), Glucagon-Like Peptide-1 (GLP-1), and leptin that have an anorexigenic effects[10,11]. However, although estrogen tends to inhibit energy intake, it can cause fluid retention and edema[8]. Meanwhile, estrogen and progestin tend to increase energy expenditure regarding energy expenditure[10,11].

Birth spacing through the use of contraceptive methods is pivotal for stunting prevention. The shorter the pregnancy interval, the greater the risk of stunting due to increased risk of anaemia and nutritional deficiencies[12]. On the other hand, the use of hormonal contraception is thought to be related to other nutritional problems, namely obesity in women, which is also an important risk factor for various non-communicable diseases. Therefore, gathering evidence related to this topic is important to help navigate between the two nutritional problems. Moreover, it is also important to identify other related factors, such as physical activity and the consumption of vegetables and fruit.

The study location was in Tebet District; according to the DKI Jakarta Riskesdas data in 2018, it was ranked the highest in the prevalence of adult women aged >18 years with overweight (16.7%) and ranked fourth in the prevalence of obesity at 35.9% in the same demography[13]. Tebet district also has the highest population density in South Jakarta. However, there is no field data regarding the relationship between contraceptive use and the incidence of obesity in the area. Hence, to add to the body of evidence regarding the overweight and obesity problem with contraceptive use in the Tebet district, this study aimed to examine the relationship between types of contraception and nutritional status, both BMI and central obesity and macronutrient intake, as well as the factors that influence the nutritional status of Women of Childbearing Age (WUS). in the Tebet District.

METHODS
Design, Time, and Place

The research design was cross-sectional. The population was women of childbearing age (WUS), aged 20 – 45 years, who live in the area served by Manggarai and Bukit Duri community health centers in Tebet District, South Jakarta. This research was conducted from April to May 2023 and received approval from the Health Research Ethics Commission of the National Development University "Veteran" Jakarta Number: 61/IV/2023/KEPK.

Sample Size Calculation and Recruitment

The sample size was calculated using the formula for estimating the proportion of one sample based on the BPS data on the proportion of women in DKI Jakarta who used contraception in 2022, resulting in a sample size of 106[14]. The sampling recruitment technique used was quota sampling among the gynecology clinics or service users at the community health centers and community health posts. Respondents were screened based on the inclusion and exclusions criteria as follows: women of childbearing age (WUS) aged between 20 – 45 years, domiciled in Tebet District or receiving contraceptive service at a health center in the Tebet District area, married couples of childbearing ages, and willing to be respondents, as proven by filling in informed consent. Meanwhile, those who were pregnant and had a history of chronic diseases that can affect nutritional status and food intake, such as diabetes mellitus (DM) and cancer, were excluded as research subjects.

Data Collection Procedure

Data was collected through a questionnaire guided and filled in by the enumerators to improve quality. Respondent characteristic data includes age, occupation, education level, household income, and parity. The questionnaire identifies contraception use history, consisting of the type of contraception currently being used, namely hormonal contraception such as pills, injections, implants, and hormonal IUDs, as well as non-hormonal contraception such as IUDs, tubectomy, natural breastfeeding methods, and diaphragms, as well as the duration of current contraceptive use. Physical activity level was measured using the short version of the International Physical Activity Questionnaire (IPAQ). The respondents' fruit and macronutrient consumption patterns were measured using the Food Frequency Questionnaire (FFQ).

Meanwhile, the respondents' daily macronutrient intake as the dependent variable for cross-tabulation was measured using the 24-hour Recall, which was taken once on weekdays and once on weekends. Dependent variables of body weight and height to obtain BMI data and waist circumference as a marker of central obesity were also taken using the standard method. Physical activity and vegetable and fruit intake are confounding variables included in the multivariate analysis model, and macronutrient intake is an independent variable to identify the factors that influence nutritional status.

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Data Analysis

Data on respondent characteristics were analyzed using univariate tests. Physical activity was categorized into low, moderate and high[15]. Vegetable and fruit intake were categorized as rare if the score was less than the average and frequent if the score was more than the average[16]. BMI classification refers to the WHO classification and waist circumference uses the International Diabetes Foundation (IDF) classification[17,18]. Adequate macronutrient intake was compared with the RDA and classified based on the Ministry of Health guideline[19]. Then, the chi-square test was used to determine the significant associations between type of contraception as an independent variable and macronutrient intake and nutritional status (BMI and waist circumference) as dependent variables. The analysis then continued by looking at the relationship between the duration of contraceptive use and nutritional status (BMI and waist circumference). The Fischer Exact test was used when the cross-tabulation data had a cell with less than five data. A multiple linear regression test was carried out with macronutrient intake, vegetable and fruit intake, and the type of contraceptive used as independent variables to identify the variables that had the most influence on BMI and waist circumference. Between the independent and dependent variables, a Spearman rank correlation test was first carried out, and those included in the regression model were variables that were found to be significantly correlated in this test.

RESULTS AND DISCUSSION
Respondents' characteristics

The biggest proportion of respondents were women in the mid-reproductive age category (25 – 34 years) (44.3%), and the household incomes were dominated by the low category (Rp. 1,800,001 – Rp. 3,000,000) (38.7%) and medium (Rp. 3,000,001 – Rp. 4,800,000) (34.9%). Most were high school graduates (66%), and the occupation was dominated by housewives or homemakers (89.6%). The respondents mostly had 1 – 2 children (60.4%). Meanwhile, most respondents live in the Manggarai area (69.8%) (Table 1).

Table 1. Sociodemographic characteristics

Characteristics	n	%
Age		
Early reproductive age (<25 years old)	14	13.2
Mid reproductive age (25 – 34 years old)	47	44.3
Late reproductive age (≥35 years old)	45	42.5
Income Level		
Very low (<Rp 1,800,000)	15	14.2
Low (Rp 1,800,001 – Rp 3,000,000)	41	38.7
Medium (Rp 3,000,001 – Rp 4,800,000)	37	34.9
Medium to High (Rp 4,800,001 – Rp 7,200,000)	9	8.5
High (>Rp 7,200,000)	4	3.8
Education		
Elementary school	11	10.4
Junior high school	16	15.1
Senior high school	70	66
College	9	8.5
Occupation		
Homemaker	95	89.6
Entrepreneurs	1	0.9
Private company employees	9	8.5
Others	1	0.9
Parity		
1 – 2	64	60.4
3 – 4	37	34.5
>4	5	4.7
Domicile Area		
Manggarai	74	69.8
Bukit Duri	32	30.2
Total	**106**	**100**

Age, household income, educational history, and parity are several factors that can influence contraceptive use and the choice of type of contraception used. Research using 2017 IDHS data analysis states that women aged 36 – 45 years have a 2.9 times greater chance of using hormonal contraception compared to those aged <20 years, and women with higher education (academic/diploma/university) have a greater chance of using hormonal contraception compared to women with low education (no school/primary school)[20]. However, analysis of 2017 IDHS data in other studies stated that there was no relationship between education and the use of hormonal contraception[21]. Other studies using different age cut points, namely 20 – 35 years and >35 years, show that there is no relationship between age and choices of contraceptive use[22].

A study in East Java stated that the higher the number of parity (number of children), the higher the

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possibility of using contraception, where multiparous women (giving birth to ≥2 children) were 4.114 times more likely to use contraception compared to primiparous women (giving birth to <2 children)[23]. Regarding the choice of type of contraception used, one study stated that women with parity ≥6 have a 1.76 times greater chance of using hormonal contraception compared to women with parity 1-2[20]. However, other studies show that the more children there are, the higher the use of long-term contraceptives such as IUDs, implants and tubectomies[22]. Household income, a measure of socioeconomic status, is also known to influence the choice of contraceptives[24]. Analysis of the 2017 IDHS data found that women with high socioeconomic status were 1.9 times more likely to use hormonal contraception compared to women with low economic status[20].

In addition to the influence on contraceptive use, age and educational history also influence the incidence of obesity in women of childbearing age. Research by Kartika and Ronoatmodjo (2019) stated that those aged 31 years or above have a 1,569 times higher risk for obesity compared to those aged less than 31 years. Women of reproductive age with low education also have a risk of obesity of 1.079 times compared to women with higher education[8].

Contraceptives Used, Physical Activity and Food Intake

In Table 2, the type of contraception used is dominated by hormonal contraception (59.4%) compared to non-hormonal contraception, including those who do not use it (40.6%). Among hormonal contraception, the type most used is the 3-month injection (24.5%), while in non-hormonal contraception, the type most used is the Spiral IUD (26.4%) and those who do not use contraception (10.4 %). This result is similar to Susenas data in the BPS report; the highest use of contraception is injectable birth control at 64.49%[4]. This result is also supported by 2018 Riskesdas data, which shows that the highest use of contraception is the 3-month injection at 42.4%[1].

Table 2. Types of contraceptives used, physical activity level, and food intake

Variables	n	%
Hormonal Contraceptive		
1-month injection	10	9.4
3-month injection	26	24.5
Pills	12	11.3
Implants	11	10.4
Hormonal IUDs	4	3.8
Total	**63**	**59.4**
Non-Hormonal Contraceptives		
Spiral IUDs	28	26.4
Lactation	2	1.9
Tubectomy	2	1.9
No contraception	11	10.4
Total	**43**	**40.6**
Physical Activity Level		
Low	75	70.8
Moderate	31	29.2
Fruit and Vegetables Intake		
Non frequent	56	52.8
Frequent	50	47.2
Macronutrients Intake		
Non frequent	52	49.1
Frequent	54	50.9
Total Respondents	**106**	**100**

Most respondents had low physical activity (70.8%), while the rest had moderate levels, and none had high levels of physical activity. These results are based on 2018 Riskesdas data, which shows that almost half (47.8%) of people aged >10 years in DKI Jakarta Indonesia had insufficient physical activity[1]. Low physical activity is also a factor that triggers obesity. People with low physical activity have an increased risk of obesity of 1.54 times greater than people with frequent physical activity[25].

More respondents rarely consume fruits and vegetables (52.8%), while more than half also frequently consume macronutrient-source food (50.9%), which can lead to excessive calorie intake. Food consumption, which is high in fat and sugar but lacking in fiber, is one of the factors that trigger obesity. Fiber intake can be obtained from consuming vegetables and fruit. Research by Nopri and Verawati (2020) shows that people who consume less fruit have a higher risk of overnutrition, 3.281 times greater than people who consume enough fruit, while people who consume less vegetables have an increased risk of overnutrition is 2.652 times greater than people who consume enough vegetables[26]n.

Table 3 shows that most respondents who used hormonal contraception are in the class I obesity category (24.5%), and the group who do not use hormonal contraceptives is in the class II obesity category (14.3%). The highest proportion of their waist circumference measurements in both groups was in the at-risk category (50.9% and 34%). The Chi-square test

showed that nutritional status, BMI and waist circumference did not show a significant relationship with the type of contraception, with a p-value of 0.081 for BMI and 0.789 for waist circumference (p-value > 0.05).

Table 3. Results of the chi-square test on the relationship between types of contraceptives with nutritional status and macronutrient intake

Variables	Type of Contraceptive			Median ± Min-Max	Mean ± SD	p-value
	Hormonal n (%)	Non-Hormonal n (%)	Total n (%)			
BMI						
Normal	20 (18.9)	10 (9.4)	30 (28.3)	26.8 kg/m² ± 17.9 kg/m² – 43.1 kg/m²		0.081
Overweight	8 (7.5)	6 (5.7)	14 (13.2)			
Class I Obesity	26 (24.5)	12 (11.3)	38 (35.8)			
Class II Obesity	9 (8.5)	15 (14.2)	24 (22.6)			
Waist Circumference						
Normal	9 (8.5)	7 (6.6)	16 (15.1)	87.5 cm ± 65 cm – 125 cm		0.789
High-Risk	54 (50.9)	36 (34)	90 (84.9)			
Energy						
Deficit	33 (31.1)	25 (23.6)	58 (54.7)	1934.3 kkal ± 1560.4 kkal – 2514.3 kkal		0.691
Normal	30 (28.3)	18 (17)	48 (45.3)			
Protein						
Deficit	15 (14.2)	13 (12.3)	28 (26.4)	62.9 g ± 43.1 g – 117.3 g		0.758
Normal	23 (21.7)	14 (13.2)	37 (34.9)			
Excessive	25 (23.6)	16 (15.1)	41 (38.7)			
Fat						
Deficit	14 (13.2)	17 (16)	31 (29.2)	63.9 g ± 32.5 g – 117.3 g		0.156
Normal	20 (18.9)	11 (10.4)	31 (29.2)			
Excessive	29 (27.4)	15 (14.2)	44 (41.5)			
Carbohydrate						
Deficit	51 (48.1)	30 (28.3)	81 (76.4)		278.5 g ± 42.3 g	0.244
Normal	12 (11.3)	13 (12.3)	25 (23.6)			
Total	**63 (59.4)**	**43 (40.6)**	**106 (100)**			

These results align with the findings of Kusumawati and Rosidah (2021), who showed no significant relationship between the use of DMPA injectable contraception and BMI[27]. Furthermore, another research by Kartika and Ronoatmodjo (2019) states that there was no influence of the use of hormonal contraception on obesity in women of reproductive age as well as research by Wasiah (2020) states that there was no relationship between hormonal contraception and the incidence of obesity[8,28].

In both groups (hormonal and non-hormonal contraceptive users), energy intake was mostly in the deficit category (31.1% and 23.6%). This result is counterintuitive, considering that most of the participants are in the obese category. However, this partly can be explained by the possibility that respondents have lowered their intake due to their weight problem. The highest protein intake in both groups was in the excess category (23.6% and 15.1%). Fat intake among hormonal contraceptive users was in the excess category (27.4%), while nonusers of hormonal contraceptives were mostly in the deficit category (16%).

Furthermore, in both groups, carbohydrate intake was mostly in the deficit category (48.1% and 28.3%). The Chi-square test results also showed that there was no significant relationship between macronutrient intake and the type of contraception, including energy, protein, fat, or carbohydrates, with a p-value of 0.691 for energy, 0.758 for protein; 0.156 for fat, and 0.244 for carbohydrates. These results are in line with research by Sugiharti et al. (2005), which states that the use of hormonal or non-hormonal contraceptives does not affect energy intake even though the use of hormonal contraceptives is associated with a higher risk of obesity[9]. The nutritional status of the respondents may also influence this result, the majority of whom are already in the obesity category and at risk of central obesity, so there have been efforts to reduce food intake so that energy intake is relatively low while protein intake is quite high.

Associations between the Duration of Contraceptives Use with Nutrition Status

Table 4 presents the results of the Fischer Exact test; it shows that the duration of hormonal contraceptive use did not show any significant associations with either BMI or waist circumference. The p-value was 0.163 for BMI and 0.282 for waist circumference (p-value > 0.05).

Table 4. Results of fischer's exact test on the relationship between the duration of hormonal contraceptive use and nutritional status

Variables	Duration of Contraceptive Use					p-value
	Hormonal					
	<6 months n (%)	6 – 12 months n (%)	13 – 24 months n (%)	>24 months n (%)	Total n (%)	
BMI						
Normal	2 (3.2)	7 (11.1)	5 (7.9)	6 (9.5)	20 (31.7)	0.163
Obesity	7 (11.1)	7 (11.1)	6 (9.5)	23 (36.5)	43 (68.3)	
Waist Circumference						
Normal	1 (1.6)	3 (4.8)	3 (4.8)	2 (3.2)	9 (14.3)	0.282
High-Risk	8 (12.7)	11 (17.5)	8 (12.7)	27 (42.9)	54 (85.7)	
Total	**9 (14.3)**	**14 (22.2)**	**11 (17.5)**	**29 (46)**	**63 (100)**	

Also, for the nonusers of the hormonal contraceptives group, the p-values were 0.248 for BMI and 0.066 for waist circumference in table 5 below (p-value > 0.05). Beksinska et al. (2021) stated that there was a weight gain after 12 months, 15 months and 18 months in users of injectable DMPA contraception and Levonorgestrel implants. However, in copper IUD users, weight gain only occurred after 12 months of use, and no weight gain at 15 and 18 months of use[29]. Research by Ibrahim et al. (2018) stated that women who use hormonal contraception have a much higher weight change after 12 months of use compared to non-hormonal contraceptive users6. In addition, research by Agustina and Kusuma (2018) stated that there was a significant difference in body weight before and after using injectable contraceptives for three months, and these changes tended to increase rather than remain constant or decrease.

Table 5. Results of Fischer's exact test on the relationship between the duration of non-hormonal contraceptive use and nutritional status

Variables	Duration of Contraceptive Use						p-value
	Non-Hormonal						
	Non-users n (%)	<6 months n (%)	6 – 12 months n (%)	13 – 24 months n (%)	>24 months n (%)	Total n (%)	
BMI							
Normal	2 (4.7)	1 (2.3)	4 (9.3)	1 (2.3)	2 (4.7)	10 (23.3)	0.248
Obesity	9 (20.9)	4 (9.3)	3 (7)	4 (9.3)	13 (30.2)	33 (76.7)	
Waist Circumference							
Normal	2 (4.7)	1 (2.3)	3 (7)	1 (2.3)	0 (0)	7 (16.3)	0.066
High-Risk	9 (20.9)	4 (9.3)	4 (9.3)	4 (9.3)	15 (34.9)	36 (83.7)	
Total	**11 (25.6)**	**5 (11.6)**	**7 (16.3)**	**5 (11.6)**	**15 (34.9)**	**43 (100)**	

On the other hand, research by Napolitano et al. (2015) showed that waist circumference, stomach-hip circumference ratio, and BMI did not differ significantly in the control group between the start of the study and after the 12 months study period of women using Desogestrel (DSG) and Levonorgestrel-releasing Intrauterine System (LNG-IUS). This weight gain is the influence of progestin and estrogen content, which affect the body's metabolism. However, several studies also state that there is no significant relationship between the use of hormonal contraception and the incidence of obesity. Thus, the relationship between the long duration of contraceptive use and the risk of central obesity in the results of this study is not due to the influence of the hormones contained in contraception on the respondents' physiology but rather due to other functions. As in the Cochrane literature study, which summarizes the effects of hormonal contraception on weight changes, some studies show an increase in body weight, but others show a decrease or no change in body weight in users of combined hormonal contraceptives or progestin-only hormonal contraceptives when compared with other groups[30,31]. Furthermore, no relationship was found between hormone dosage and weight gain[32].

Factors Influencing Nutrition Status

Neither the use of the type of contraception nor the duration of contraceptive use has a significant relationship with BMI or waist circumference, so it is necessary to carry out a multiple linear regression test to see the factors that most influence nutritional status, both BMI and waist circumference, as seen in Table 5 below. The independent variables included in the regression model have a significant correlation in the Spearman rank correlation test, namely the fat and carbohydrate intake variables on BMI and then the protein, fat and carbohydrate intake variables on waist circumference. Vegetable and fruit intake did not have a significant correlation with BMI or waist circumference, and protein intake did not have a significant correlation with BMI, so it was not included in the model.

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Table 6. Multiple linear regression model

Variables	Predictors	B Coefficient	p-value	95% CI for B		F	Sig.	Adjusted R²
				Lower Bound	Upper Bound			
BMI	(Constant)	7.722	0.109	-1.753	17.197	7.8	**0.000**	**0.206**
	Fat	0.104	0.000	0.05	0.159			
	Carbohydrate	0.042	0.001	0.019	0.065			
	Physical Activity	-1.851	0.079	-3.923	0.22			
	Type of Contraceptives	1.875	0.054	0.033	3.782			
Waist Circumference	(Constant)	44.771	0.000	25.615	63.926	12.3	**0.000**	**0.244**
	Fat	0.241	0.000	0.128	0.355			
	Carbohydrate	0.117	0.000	0.068	0.166			
	Physical Activity	-3.644	0.098	-7.971	0.682			

CI = Confidence Interval; Sig. = Significance value

The regression model shows that fat and carbohydrate intake significantly influence BMI and waist circumference, with a p-value of 0.000 and 0.001 for carbohydrate and fat, respectively. At the same time, the p-value for their effect on waist circumference was 0.000 for each carbohydrate and fat. The R^2 value is 0.236 for BMI and 0.266 for waist circumference, which means that fat and carbohydrate intake simultaneously influence 23.6% of BMI and 26.6% of waist circumference. Meanwhile, 76.4% of BMI and 73.4% of waist circumference were influenced by other variables outside this regression equation or other variables not studied.

The linear regression equation is BMI = 7.722 + 0.104 fat + 0.042 carbohydrates − 1.851 physical activity + 1.875 types of contraception, which shows that an increase in BMI is associated with an increase of 0.104 times fat intake and an increase of 0.042 times carbohydrates intake. Meanwhile, the effect of physical activity reduces BMI, and hormonal contraception increases it. However, in this model, the role of both is not significant because most of the respondents have low physical activity and use hormonal contraception. Meanwhile, for waist circumference, the equation is waist circumference = 44.771 + 0.241 fat + 0.117 carbohydrates − 3.644 physical activity. These results show that an increase in waist circumference is associated with 0.241 times increase in fat and 0.117 times increase in carbohydrate intake. The effect of physical activity is reduced, but in this model, its role is insignificant because most respondents have low physical activity.

Research by Cao et al. (2020) also states that the higher the fat intake, the higher the risk of obesity[33]. Similar results were also found in research by Desmawati et al. (2019), which states that fat intake influences BMI[34]. However, both studies showed the opposite for carbohydrate intake. Cao et al. (2022) stated that a higher carbohydrate intake reduces the risk of overnutrition/obesity. In contrast, Desmawati et al. (2019) stated that carbohydrate intake does not significantly affect BMI.
Meanwhile, for waist circumference, these results are not in line with the research of Kooshki et al. (2018), which states that there is no significant relationship between macronutrient intake, whether energy, fat, protein, or carbohydrates, on the stomach-hip circumference ratio in women[35]. However, research by Halkjaer et al. (2006) stated that carbohydrates from grain and tuber products

and fruit and vegetable products have a significant relationship with women's waist circumference[36]. Regardless of the conflicting results, our study highlighted the importance of limiting calorie intake by ensuring non-excessive intake of calories, both carbohydrates and fat, to maintain a healthy weight.

Despite offering several insights regarding the role of contraceptives on nutrition status and macronutrients, it is taken among women of reproductive age. There are several limitations in this study it did not differentiate between types of hormonal contraception between hormonal and non-hormonal contraceptive users or between contraceptive users and non-users, the sampling technique uses quota sampling where the respondents were women using the community health center and community-based health services; in nature, this technique excluded women using other services, and the sample size was small, thereby limiting generalization, it did not describe the extent of the relationship between the independent and confounding variables on the dependent variables.

CONCLUSIONS

The use of both hormonal and non-hormonal types of contraceptives and the duration of contraceptive use did not show a significant relationship with BMI and waist circumference among the study participants. In addition, no significant relationships were found between the use of contraception and macronutrient intake, including energy, fat, protein and carbohydrate intake. This result could be because most respondents were overweight or obese; thus, there was the possibility of efforts to lose weight by reducing intake. However, multiple linear regression tests showed that fat and carbohydrate intake significantly affected BMI and waist circumference. Therefore, programs for overweight and obesity prevention among this demographic should worry less about the effects of hormonal contraception; instead, they should be focused on ensuring sufficient physical activity and balanced nutritional intake, especially for carbohydrates and fats.

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The authors hereby declare no conflict of interest.

Author Contributions

LA: writing-original draft, investigation, data curation, formal analysis; YCO: conceptualization, supervision, data curation, writing-review & editing; AF,DS: supervision, draft review.

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