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Relationship between nutritional status and periodontal disease among pregnant women attending Abakpa Nike health center, Enugu, Enugu state, Nigeria

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Abstract

Pregnancy is a period during which one or more offspring develop inside the womb of a woman. It lasts for a period of nine months comprising of three trimesters. Obesity has been proven to have an adverse influence on the effect of pregnancy hormones on the periodontal tissue. It produces inflammatory cytokines which aggregates the systemic inflammatory conditions exacerbated by pregnancy hormones which predisposes the periodontium to periodontal disease. The aim of the study is to evaluate the relationship between nutritional status and periodontal disease among pregnant women attending Abakpa Nike Health Center. A sample size of 70 pregnant women attending Abakpa Nike Health Center, Enugu was randomly selected for this study. Their nutritional status was determined using the Body Mass Index analysis and their periodontal health was also examined using basic periodontal probe and mouth mirror. It was discovered that 42 (60%) of the pregnant women were diagnosed with periodontal diseases and 22 (52.4%) of the pregnant women diagnosed with periodontal disease presented with gingivitis. The study also showed that 34 (76%) of the pregnant women in their second trimester and 6 (50%) of the women in their third trimester were diagnosed with periodontal disease. It also revealed that majority 29 (69.0%) of the pregnant women diagnosed with periodontal disease had unhealthy body weight. This shows that there is a significant relationship between nutritional status and periodontal disease among pregnant women attending Abakpa Nike Health Center, Enugu. Therefore this study recommend that sensitization programmes should be included in the ante natal programmes to educate the pregnant women on how to maintain a healthy body balance and improve oral hygiene especially during pregnancy.

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Introduction

Pregnancy also known as gestation is a period during which one or more offspring develop in the womb of a woman. It lasts for a period of nine months comprising of three trimesters [1]. Pregnancy brings about variety of changes to the body and these changes include hormonal changes which worsen the production of inflammatory cytokines by adipose tissue and aggregate the systemic inflammatory conditions predisposing them to establishment or worsening of inflammatory diseases such as periodontal disease in obese and overweight individuals [2].

An analysis of the Third National Health and Nutrition Examination Survey (NHANES III) showed that Body Mass Index was significantly associated with periodontal disease [3]. Body Mass Index has been considered a simple method for the analysis of nutritional status and according to Willett et al. [4] is classified as ≤ 18.4 for underweight, $\geq 18.5 > 24.9$ as normal, $\geq 25 < 29.9$ as overweight, $\geq 30 < 39.9$ as obese and ≥ 40 as morbidity obese.

Periodontal disease is a chronic inflammatory disease which begins at the gingiva and progresses downwards and affects the supporting structures of the tooth i.e the periodontal ligament, cementum and alveolar bone, if left untreated. The clinical features of periodontal disease are bleeding gum, dull gnawing pain, bad breath, mobility of the teeth, pathological tooth migration, gingival recession, clinical attachment loss and exfoliation of the tooth in severe cases [5]. Armitage [6] further explained in a later study that periodontal disease results from a complex interplay between subgingival biofilm and host immune inflammatory event which develops in the gingival and periodontal tissue in response to the challenge presented by the bacteria.

Ritchie *et al.* [7] in their study established an association between higher body fat content and increased gingival bleeding in pregnant women. Other studies have also shown that oral tissue can be affected during pregnancy and these changes are mostly marked in gingival tissues [8]. Silness and Leo [8] further explained that although it is triggered by buildup of bacterial plaque, periodontitis can be exacerbated by vascular and hormonal changes. Taken alone, these changes do not determine the cause of the infectious process but they aggravate the response of the tissue in the presence of bacterial plaque. These conditions are produced in conjunction with an increased percentage of bacteria especially *Prevotella Intermedia* which is caused by increase in serum levels of circulating estrogen and progesterone. Overweight and obesity are predisposing factors of periodontal diseases and adverse pregnancy outcomes and hormonal changes that occur during pregnancy can affect the oral tissues marked mostly in the periodontal tissues so it is important to evaluate the relationship between nutritional status and periodontal disease among pregnant women attending Abakpa Nike Health Centre, Enugu.

Research methodology

Description of study area

This research was carried out at Abakpa Nike Health Center located at latitude $7^{\circ}29'09.2''N$ and longitude $8^{\circ}12'41.7''E$ in

Enugu, Nigeria. The health center was established in 1975. It has boundaries with Agip filling station and Model Ideal College, Abakpa. The health center has many units which include ante-natal unit, immunization department, dispensary and injection unit, labor and delivery department, family planning department and National Programme on Immunization Unit (NPI). It has a total number of sixteen [16] health workers made up of twelve [12] trained health workers and five [5] non-trained health workers (Source: Health and Staff Records).

Research design and population size of the study

This research design was a cross sectional study in which pregnant women attending Abakpa Nike Health Center was examined to evaluate the relationship between nutritional status and periodontal disease.

The population of pregnant women visiting the health center per month was an average of 230 which means an estimated number of 2760 pregnant women yearly (Source: Health Record, October 7, 2019).

Sample size determination and sampling technique

Among the total number of women that visited the health center monthly (230), only 70 pregnant women agreed to participate in the study and so they were used for the study. All-inclusive sampling technique was used in selecting the pregnant women that participated in the study.

Method of data collection

The study participants were interviewed to obtain their demographic data.

For data on nutritional status, Body Mass Index (BMI)

The mathematical formula for $BMI = Kg/m^2$

Where kg is the weight in kg and m^2 is the height in meter square.

The steps used to obtain data for this calculation for each pregnant woman was:

- The woman removed footwear all other baggage.
- She stood tall and straight on the weighing balance.
- I took reading on the weighing balance avoiding error due to parallax.
- She stood tall and straight on a smooth surface against a smooth wall.

I took reading of the pregnant woman with a measuring tape calibrated in cm then converted to meters by dividing by 100 and the square root calculated.

Data collected was substituted into the formula for BMI calculation. Data obtained was compared with the WHO standard BMI chart to determine the nutritional status and recorded accordingly.

On data for Periodontal Disease, the oral cavity was first examined for swelling and redness using a mouth mirror. A Basic Periodontal probe was used to check for the presence of 4 or

more teeth showing at least one site with 4 mm periodontal pocket depth and clinical attachment loss at the same site with Bleeding On Probing (BOP). Periodontal pocket depth of <3 mm with Bleeding On Probing (BOP) indicated presence of gingivitis and periodontal pocket depth of ≥3 mm indicated presence of periodontitis as used by Vogt et al [9]. All the data collected was recorded using a well-designed data sheet and data was analyzed.

Data analysis and presentation

The data collected was sorted in categories of age, weight, height, nutritional status, presence of periodontal disease and was analyzed using simple frequency table and percentage calculation. The results were in tables, figures and essay form for easy understanding.

Test for hypothesis

Hypothesis was tested using Pearson's Product Movement Correlation Coefficient (PPMCC) mathematically represented as

$$r = \frac{\sum xy}{\sqrt{\sum xx \sum yy}}$$

where

r = Correlation coefficient

$\sum XY$ = Summation of the relation between the dependent and independent variables

$\sum XX$ = Summation of the independent variables

$\sum YY$ = Summation of the dependent variables

Result

This chapter dealt with the analysis and presentation of results. Data was collected in October 2019 and was obtained through personal interview, intra oral examination and measurement of weight and height. Data was analyzed and results were presented below.

Table 1: Age range of pregnant women who visited Abakpa Nike Health Center.

Age Range	Frequency	(%)
16-20	8	11.5
21-25	19	27.1
26-30	24	34.3
31-35	15	21.4
36-40	4	5.7
Total	70	(100)

Table 1 above shows the age range of the pregnant women accessed. 8 (11.5%) were between ages 16-20 years, 19 (27.1%) were between ages 21-25 years, 24(34.3%) were between ages 26-30 years, 15 (21.4%) were between ages 31-35 years and 4(5.7%) were between ages 36-40 years. Most 24 (34.4%) of the pregnant women examined were of age range 26-30 years old.

Table 2: Stages of Pregnancy of the women assessed.

Stage of Pregnancy	Frequency	(%)
1 st Trimester	13	18.6
2 nd Trimester	45	64.3
3 rd Trimester	12	17.1
Total	70	(100)

Table 2 shows the various stages of pregnancy of the women assessed. A total of 13 (18.6%) of the women were in the first trimester, 45 (64.3%) were in the second trimester and 12(17.1%) were in the third trimester. Greater percent (64.3%) of the pregnant women examined were in their second trimester.

Table 3: Determination of periodontal disease among the pregnant women studied.

Periodontal disease	Frequency	(%)
Absent	28	40
Present	42	60
Total	70	(100)

Table 3 shows that 42(60%) of the pregnant women had periodontal disease and 28 (40%) of the pregnant women did not have periodontal disease. Most (60%) of the pregnant women examined were diagnosed with periodontal disease.

Table 4: Type of periodontal disease affecting these pregnant women.

Type of Periodontal Disease	Frequency	(%)
Gingivitis	22	52.4
Periodontitis	20	47.6
Total	42	(100)

Table 4 shows that of the 42 (60%) pregnant women that were diagnosed with periodontal disease, 22(52.4%) presented with gingivitis and 20(47.6%) presented with periodontitis. A greater fraction (52.4%) of the pregnant women diagnosed with periodontal disease presented with gingivitis.

Table 5: Stage of pregnancy and periodontal disease among the pregnant women

Stage of Pregnancy	Frequency	(%)
1 st Trimester	2	15.4
2 nd Trimester	34	76
3 rd Trimester	6	50
Total	42	(100)

Table 5 shows the stage of pregnancy affected. It shows that of the 13 pregnant women in the first trimester, 2(15.4%) were diagnosed with periodontal disease; 34(76%) of the 45 pregnant women in the second trimester were with diagnosed with periodontal disease and 6(50%) of the 12 pregnant women in the third trimester were diagnosed with periodontal disease. Most (76%) of the pregnant women in their second trimester and most (50%) of the pregnant women in their third trimester were diagnosed with periodontal disease.

Table 6: Nutritional status of the pregnant women used in the study.

Nutritional Status	Frequency	(%)
Underweight	5	7.1
Normal weight	28	40
Overweight	24	34.3
Obese	13	18.6
Total	70	(100)

Table 6 shows the nutritional status of the pregnant women assessed. It shows that 5(7.1%) of the pregnant women were underweight, 28(40%) of the pregnant women were of normal weight, 24(34.3%) of pregnant women were overweight and 13(18.6%) of the women were obese. Most (40%) of the pregnant women assessed had normal body weight.

Table 7: Nutritional status of the pregnant women with periodontal disease.

Nutritional Status	Frequency	(%)
Underweight	3	7.1
Normal weight	13	31.0
Overweight	15	35.7
Obese	11	26.2
Total	42	(100)

Table 7 shows the nutritional status of the pregnant women that were diagnosed with periodontal disease. It shows that of the 48 pregnant women that were diagnosed, 3(7.1%) were underweight, 13(31%) were of normal weight, 15(35.7%) were overweight and 11(26.2%) were obese. Of the pregnant women diagnosed with periodontal disease, majority (69.1) of them had unhealthy body weight; overweight (35.7%) and obese (26.2).

Table 8: Nutritional status of pregnant without periodontal disease.

Nutritional Status	Frequency	(%)
Underweight	2	7.14
Normal weight	15	53.57
Overweight	9	32.15
Obese	2	7.14
Total	28	(100)

Table 8 shows the nutritional status of the pregnant women without periodontal disease. It shows that of the 28 pregnant women without periodontal disease 2(7.14%) were underweight, 15(53.57%) were of normal weight, 9(32.15%) were overweight and 2(7.14%) were obese. Most (53.57%) of the pregnant women that were not diagnosed with periodontal disease had normal body weight.

Table 9: Nutritional Status of the pregnant women diagnosed with periodontal disease showing their periodontal health status.

Nutritional Status	Freq	(%)	Gingivitis Freq	Periodontitis Freq	Total Freq	(%)
Underweight	5	7.1	2	1	3	7.1
Normal weight	28	40	6	7	13	31.0
Overweight	24	34.3	9	6	15	35.7
Obese	13	18.6	5	6	11	26.2
Total	70	100	22	20	42	(100)

Table 9 shows that of the 5 underweight pregnant women, 2 presented with gingivitis and 1 presented with periodontitis; of the 28 normal weight pregnant women, 6 presented with gingivitis and 7 presented with periodontitis; of the 24 overweight pregnant women, 9 presented with gingivitis and 6 presented with periodontitis and of the 13 obese pregnant women, 5 presented with gingivitis and 6 presented with periodontitis.

Result of test of hypothesis

Result for test of hypothesis was calculated using Pearson's Product Movement Coefficient Correlation (PPMCC)

H₀: There is no significant relationship between nutritional status and periodontal disease among pregnant women attending Abakpa Nike Heath, Enugu.

H₁: There is a significant relationship between nutritional status and periodontal disease among pregnant women attending Abakpa Nike Heath, Enugu.

$$r = \frac{\sum XY}{\sqrt{\sum XX \cdot \sum YY}}$$

$$= \frac{147}{165.25}$$

$$= 0.89$$

Decision

The relationship between nutritional status and periodontal disease among pregnant women attending Abakpa Nike Health Center, Enugu is 0.89. This shows a strong positive relationship between nutritional status and periodontal disease in pregnancy. Therefore I accept the alternative which states that there is a significant relationship between nutritional status and periodontal disease among pregnant women attending Abakpa Nike Health Center, Enugu.

Discussion

This study was carried out on 70 pregnant women who attended Abakpa Nike Health Center Enugu in October 2019. It revealed that most 42 (60%) of the pregnant women examined were diagnosed with periodontal disease. This shows that pregnancy is a risk factor of periodontal disease and agrees with the findings of Silness and Leo. [8] who revealed that oral tissues can be affected during pregnancy and these changes are mostly marked in the gingival tissues. This is due to an increased percentage of bacteria especially *P. Intermedia* which is caused by increase in serum levels of oestrogen and progesterone.

Also, this study revealed that a greater fraction 22 (52.4%) of the pregnant women diagnosed with periodontal disease presented with gingivitis. This is as a result an improved oral hygiene upon noticing the disease which hinders progression.

Furthermore, this study shows that most 34 (76%) of the pregnant women in their second trimester and most 6 (50%) of the pregnant women in their third trimester were diagnosed with periodontal disease. This revealed that greater percent of pregnant women develop periodontal disease in the second and third trimester in harmony with the findings of Tilankaratne et. al. [10] who upon review stated that periodontal disease severity gradually increases in severity from 12th week until the 36th week of gestation. Other studies by Tilankaratne et. al. [10] and Figuero et. al. [11] are also in conformity with this result as it revealed that upon evaluation of pregnant women, although, the plaque levels remain unchanged, the gingival index was significantly increased in the second trimester and peaked in the third trimester. This is possible because of the higher levels of progesterone during the second and third trimester which causes laxity or loosening of ligaments throughout the body.

This study also brings to light that of the pregnant women diagnosed with periodontal disease, majority 26 (61.9) of them had unhealthy body weight; overweight 15 (35.7%) and obese 11 (26.2). This is in line with the findings of Ritchie et. al. [7] who

established a positive association between higher body fat and gingival bleeding in pregnant women.

Conclusion

From the study, pregnant women showed an increased susceptibility to periodontal disease due to an increased production of inflammatory cytokines by adipose tissue which aggregates the systemic inflammatory condition; and increased inflammatory response to gingival tissues due to local irritants like dental plaque, calculus and hormonal changes (oestrogen and progesterone) as a result of pregnancy which can modulate vascular response and connecting tissue interaction with inflammatory mediators. Hence, there is a significant relationship between nutritional status and periodontal disease in pregnancy. Based on the results, it is recommended that:

1. Pregnant women should be provided with effective oral care at all stages of pregnancy especially in their second and third trimester.

2. The government should establish at least one dental clinic at every local government of the state to make dental treatment accessible to every individual especially pregnant women.

3. Sensitization programs should be organized at regular intervals, especially for the pregnant women, to create awareness on the need to maintain a good oral hygiene and the consequences of poor oral hygiene.

4. Oral health education and dietary counseling should be incorporated in ante-natal visit programs.

5. Enlightenment programmes should be organized at intervals to sensitize the general public especially the pregnant women on the need to maintain healthy nutritional status and the effects of unhealthy nutritional status.

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