

## PREVALENCE OF NUTRIENT CANALS ANTERIOR MANDIBULAR IN HYPERTENSIVE AND NON-HYPERTENSIVE PATIENTS USING PERIAPICAL RADIOGRAPHS

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### Abstract

Nutrient canals are channels that contain nerves and blood vessels in the form of radiolucent lines that are often seen in the mandibular anterior teeth using periapical radiographs. The availability of nutrient canals are related to any systemic diseases including hypertension. The aim of this study was to find out the prevalence of nutrient canals anterior mandibular in hypertensive and non-hypertensive patients using periapical radiographs analysis. This research is carried out in the Radiology Unit of Faculty of Dentistry, University of North Sumatera. The type of this research is descriptive research, which is to determine the nutrient canals prevalence in patients with hypertension and non-hypertension of the anterior mandibular region. Cross Sectional approach was used to examine 30 people who came to the Dental and Oral Hospital with the age between 20-60 years. Periapical photo of sample was taken once. The results indicated that the nutrient canals anterior mandibular prevalence in hypertensive patients which account to 73,33% and non-hypertensive patients was 26,67% in periapical radiography

**Keywords:** nutrient canals, anterior mandibular, hypertension non-hypertension.

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### INTRODUCTION

Radiography is an important diagnostic tool and commonly used to investigate dental diseases and tissue surroundings. Certain radiographic findings can be important if evaluated, one such finding is the presence of nutrient canals (Ncs).<sup>1</sup> Nutrient canals are spaces in bone considered as canals which circulate blood vessels and nerves to be required for the tissue growth and development. Nutrient canals are often seen in the mandibular anterior area as a radiolucent line.<sup>2</sup> The nutrient canals are the anatomical structures found in the alveolar bone. The nutrient canals can be used to identify teeth by comparing antemortem-postmortem radiographs in forensic identification.<sup>3</sup>

Some researchers proposed that nutrient canals are normal anatomic formation, while others said these are pathological formations.<sup>4</sup> According to the literature, the availability of nutrient canals are related to pathological conditions such as hypertension (HT), diabetes mellitus (DM), tuberculosis, rickets, periodontal disease, disuse atrophy, calcium deficiency, and coarctation of aorta.<sup>5,6</sup> Intraoral radiographs can help in recognizing differences in the appearance, number, and location of nutrient canals. Dentists also have a role in suspecting any systemic diseases such as hypertension.<sup>4</sup>

According to Sukhleen et al (2019), in a comparative study of 600 patients from the age of 20-60 years, in which Group I: 200 hypertensive patients were randomly selected (average age = 40.72 years), group II: 200 DM patients (average age 45.03 years), and group III: 200 healthy patients (average age = 42.05 years) were performed to knowing the availability of nutrient canals in each group.

The presence of nutrient canals was 1.9 times more in group I compared to group III while it was 2.1 times more in group II than in group III. The comparison between groups was statistically significant. More nutrient canals in group I and II compared to group III. however, statistically there was no significant difference between group I HT and group II DM.<sup>4</sup>

According to Pierrakou et al (2019), said that the increased number of nutrient canals seen on intraoral periapical radiographs in the anterior mandibular area can be an adjunct to detect hypertension and diabetes mellitus. Nutrient canals with disease severity was no significant relationship. Increasing number of nutrient canals might provide diagnostic instructions to the dentists to conduct further investigation of hypertension and diabetes mellitus.<sup>4</sup>

According to Vanaja et al (2017), compared with the control group, the prevalence of nutrient canals observed was very significant in diabetes mellitus (27%), significant in edentulous (22%), hypertension (21%) and periodontitis groups (17%). Highly significant prevalence of age was observed in the periodontitis and edentulous groups. A significant increase in the group hypertension and diabetes mellitus.<sup>1</sup>

Based on research conducted by Preeti et al (2014), showed that nutrient canals prevalence is higher in diabetes mellitus and hypertensive patients with periodontitis conditions. Increased nutrient canals is an additional diagnostic indicator for detection of systemic diseases such as diabetes mellitus and hypertension.<sup>6</sup>

According to Morteza et al (2013), the presence of nutrient canals was 37.5% in hypertensive patients and 53.1% in normotensive patients, but statistically there was no difference. The authors found no correlation between the presence of nutrient with the duration of hypertension and controlled hypertension. The results showed no significant correlation between hypertension and nutrient canals anterior mandibular.<sup>5</sup> To view nutrient canals periapical intra-oral radiographs are often used because of this can see the entire structure of a tooth from the crown to the periapical area and assist in recognizing differences in appearance, number, and location of nutrient canals.<sup>4</sup>

## **RESEARCH METHODOLOGY**

The type of this research was a descriptive study with cross sectional approach used to investigate the prevalence of nutrient canals in hypertensive and nonhypertensive patients in mandibular anterior teeth using periapical radiographic analysis. This research was conducted in Radiology Unit of Faculty of Dentistry, University of North Sumatra. The sample was hypertensive and non-hypertensive patients. This research began with distributing and filling the questionnaire to obtain the data and medical history of patients.

Then, the researcher did intraoral clinical examination to check the complete anterior teeth of the sample using dental tweezers, dental probe, and mouth mirror. Furthermore, the researcher evaluated the results of questionnaire as well as selecting hypertensive and non hypertensive samples according to the inclusion criteria.

Patients who complied with inclusion and exclusion criteria are briefed and asked to fill out informed consent if they agreed to be a sample of this research. Those who had agreed

are subjected to take a radiograph photo using intraoral periapical radiographs in the anterior mandibular region. The evaluation of nutrient canals in periapical radiographs then are recorded on the research sheet.

The collected data were analyzed by computerized using SPSS programs. The analysis of data used descriptive statistical tests to display data in the form of frequency and percentage. This research had received ethics approval from the ethical commission FK USU (Health Research Ethical Committee of University of North Sumatera) and the subjects selected as the sample of this research had also been given an informed consent before their enrollment in this study.

## RESULTS

Table 1 showed the prevalence of nutrient canals anterior mandibular in 15 hypertensive and 15 nonhypertensive patients. Of 15 patients, 11 hypertensive (73,33%) and 4 non hypertensive (26,67%) exhibit nutrient canals. Meanwhile, of 15 patients, 6 hypertensive (40%) and 9 non hypertensive (60%) did not have any nutrient canals

**Table 1.** Nutrient Canals Anterior Mandibular Prevalence in Hypertensive and Nonhypertensive Patients

Nutrient Canals	Hypertensive		Non-Hypertensive		Total	
	n	%	n	%	n	%
Present	11	73,33	4	26,67	15	100
Absent	6	40	9	60	15	100
Total	17		13		100	

Table 2 showed the prevalence of age group in hypertensive and non hypertensive patients. It consisted of 15 samples with age 20-29 years; 14 non hypertensive and 1 hypertensive, 2 samples age 30-39 years; 1 non hypertensive and 1 hypertensive. Then, 8 samples age 40-49 years; 0 non hypertensive and 8 hypertensive. There were 5 samples with age ≥50 years; 0 non hypertensive, and 5 hypertensive.

**Table 2.** The Prevalence of Age Group in hypertensive and nonhypertensive patients

Age	Hypertensive		Non-Hypertensive		Total	
	n	%	n	%	n	%
20-29	1	6,67	14	93,33	15	100
30-39	1	50	1	50	2	100
40-49	8	100	0	0	8	100
>= 50	5	100	0	0	5	100
Total	15		15		30	

Table 3 showed a higher nutrient canals prevalence in the age of 40-49 years accounted to 7 (87,5%) and a lower nutrient canals prevalence in the age of 30-39 was 2(100%).

**Table 3.** Nutrient Canals Anterior Mandibular Prevalence in Hypertensive and Nonhypertensive Patients Based on Different Age Groups

Age	Present		Absent		Total	
	n	%	n	%	n	%
20-29	6	40	9	60	15	100
30-39	2	100	0	0	2	100
40-49	7	87,5	1	12,5	8	100
>= 50	2	40	3	60	5	100
Total	17		13		30	100

Table 4 showed a higher nutrient canals prevalence in the age of 40-49 years accounted to 7 (87,5%).

**Table 4.** Nutrient Canals Anterior Mandibular Prevalence in Hypertensive Patients Based on Different Age Groups.

Age	Present		Absent		Total	
	n	%	n	%	n	%
20-29	1	100	0	0	1	100
30-39	1	100	0	0	1	100
40-49	7	87,5	1	12,5	8	100
>= 50	2	40	3	60	5	100
Total	11		4		15	100

Table 5 showed a lower nutrient canals prevalence in the age of 20-29 years was 5(35,71%).

**Table 5.** Nutrient Canals Anterior Mandibular Prevalence in Nonhypertensive Patients Based on Different Age Groups

Age	Present		Absent		Total	
	n	%	n	%		%
20-29	5	35,71	9	64,29	14	100
30-39	1	100	0	0	1	100
40-49	0	0	0	0	0	100
>= 50	0	0	0	100	0	100
Total	6		9		15	100

Figures of the Presence-Absence of Nutrient Canals Anterior Mandibular in Nonhypertensive Patients Using Periapical Radiographs Analysis

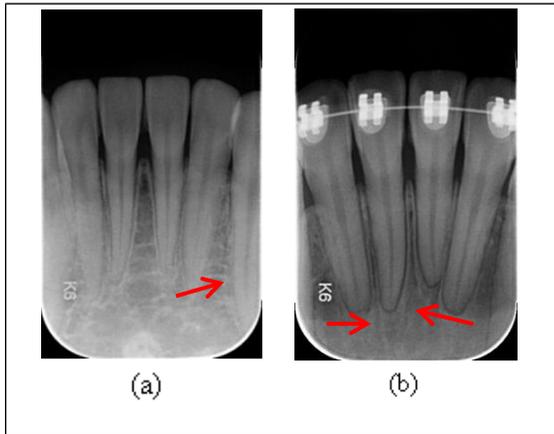


Figure 1. (a) Nutrient canals showed in non hypertensive patient age 22 years (personal documentation)  
(b) Nutrient canals showed in nonhypertensive patient age 23 years (personal documentation)

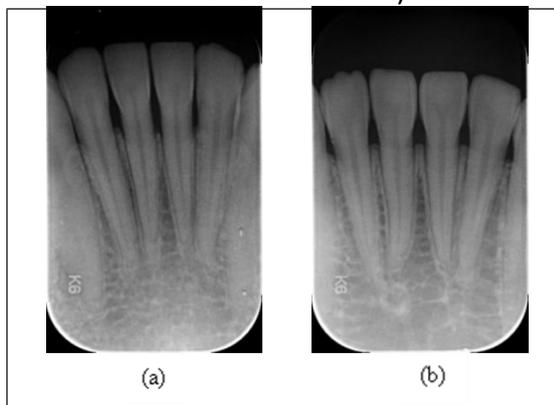


Figure 2. (a) Nutrient canals did not show in nonhypertensive patient age 23 years (personal documentation)  
(b) Nutrient canals did not show in nonhypertensive patient age 22 years (personal documentation)

### Figures of Presence-Absence of Nutrient Canals Anterior Mandibular in Hypertensive Patients Using Periapical Radiographs Analysis

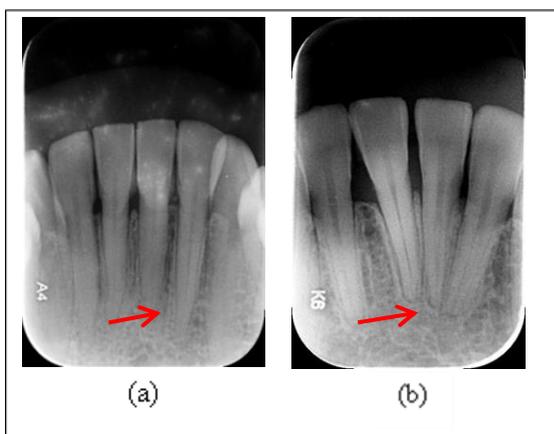


Figure 3. (a) Nutrient canals showed in hypertensive patient age 43 years (personal documentation)

(b) Nutrient canals showed in hypertensive patient age 37 years (personal documentation)

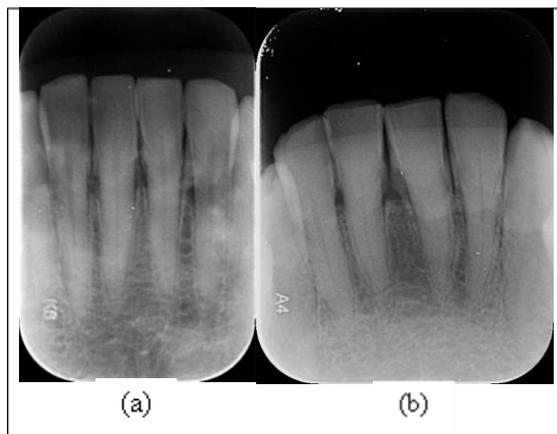


Figure 4. (a) Nutrient canals showed in hypertensive patient age 52 years (personal documentation)

(b) Nutrient canals showed in hypertensive patient age 56 years (personal documentation)

## DISCUSSION

This research was conducted by observing the results of periapical radiographs photos in hypertensive and nonhypertensive patients at Dental and Oral Hospital, University of North Sumatera. At the time of conducting this research, there were some obstacles due to Covid-19 pandemic situations which was difficult to invite the hypertensive patients, as the samples in this study were old on average and they fear of being exposed to virus while taking radiographs photos. This observation was made to investigate the prevalence of nutrient canals anterior mandibular region of hypertensive and non hypertensive patients using periapical radiography analysis which was undertaken to 80 samples age of 20-60 years. From 80 samples, it consisted of 40 patients with hypertension and 40 patients with nonhypertension.

In our study, it is obtained that the prevalence of nutrient canals in hypertensive patients was 73,33% (11 patients) and 26,67% (4 patients) in non hypertensive (table 1). This frequency was almost the same as the results of research conducted by Preeti et al. (2014) which showed nutrient canals prevalence in patients with hypertension was higher accounted to 73.33% and prevalence of nutrient canals in non hypertension was lower accounted to 26.67%.<sup>6</sup>

Meanwhile, nutrient canals prevalence absence in hypertensive patients was 40%(6 patients) and in non hypertensive patients was 60% (9 patients), as seen in table 1. It also almost had the same results of research conducted by Abdar et al. (2014) which showed lower nutrient canals prevalence in hypertensive patients was 37.5% and nutrient canals prevalence in non hypertension was slightly higher 53.1%.<sup>5</sup>

Patni et al. (2014) concluded that the presence of nutrient canals in hypertensive patients was higher than in the normal group (non-hypertensive). According to the study of Iqbal et al, (2015) there is an increase in nutrient canals in hypertensive patients, this is due to dilation of small blood vessels (dilatation of arterioles), hyperplasia of blood vessel walls, hypertrophy, thickening of arterial walls, arteriosclerosis.<sup>8</sup>

The increase in the presence of nutrient canals in hypertensive patients also occurs due to the narrowing of the lumen (channel in the blood vessels, the small space in the middle of the arteries) so that more collateral vessels open up to compensate for the reduced blood supply.<sup>8</sup>

Not all radiographs can detect nutrient canals because of their and of the tiny and various size. Lovette asserted the shape of the nutrient canals based on its radiography appearance varies i.e. there were radiolucent lines such as fine threads whose direction is circular indiscriminately, radiolucent lines are medium, and some form radiolusen lines like boards.<sup>9</sup> According to some researchers, nutrient canals nutrient canals are normal anatomic formation, while others said these are pathological formations related to various pathological conditions such as hypertension.<sup>2</sup>

Mani et al stated that nutrient canals prevalence in hypertensive patients was higher than in the control group. The increasing number in nutrient canals may be due to the local and systemic diseases found in the patient.<sup>2</sup>

When compared to normal samples (non hypertension) the presence of nutrient canals was also found in hypertensive patients with bone resorption.<sup>2</sup> The incidence increased with the development of poor periodontal conditions. Nutrient channels are more frequently found in cases where the alveolar bone has an above average density with small trabecular space.

The apparent cause of the nutrient channel due to the availability of periodontal disease which causes sclerotic changes in the trabecular bone pattern and to the ability of the radiograph to record thinner bone structures more clearly, this statement corresponds to the results of a periapical intra-oral radiography photo graphic in figure 8 that showed to have alveolar bone resorption.<sup>5</sup>

According to Iqbal et al, (2015) the findings of this study provided an indication to suspect hypertension in patients whose anterior radiography results showed nutrient canals. The prevalence of nutrition channels is higher in hypertension, This is also influenced by other factors such as periodontitis. The increased presence of nutrient canals anterior mandibular seen on periapical intra-oral radiographs can be an additional addition to detection of systemic disease.<sup>2</sup>

According to Prashant et al, (2018) more incidence of nutrient canals were found in people over the age of 40 and fewer in people aged less than 30 years and over 60 years.<sup>3</sup> This statement was in accordance with the results of the study in tables 2, 3, and 4 that ages 40-49 years of presence and nutrient canals prevalence was higher in hypertensive patients because it was associated with the selection of samples in hypertensive patients over 40 years old. But Bilge et al also said that the presence of nutrient canals in older samples was larger than younger samples.<sup>5</sup>

Therefore, it is important to identify nutritional channels in periapical intra-oral radiographs as it can serve as one of the additional diagnostic markers of any systemic diseases, such as hypertension.

With this mind, everytime a dentist reads the patient's radiography results and inadvertently sees nutrient canals does not mean that the patient can directly be said to be hypertensive, only that the dentist can suspect the systemic disease of hypertension in the patient for further information and observation of the dentist patient can give a referral to the general doctor. It takes further examination coupled with other anamnesa to strengthen the suspected hypertension

## **CONCLUSION**

The results from this study it can be concluded that the prevalence of nutrient canals anterior mandibular showed in hypertensive patients is higher at 73,33 % than nonhypertensive was 26,67 %.

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