*Journal of Pharmaceutical Research International*

***x(x): XX-XX, 20YY; Article no.JPRI.80469***
***ISSN: 2456-9119***
*(Past name: British Journal of Pharmaceutical Research, Past ISSN: 2231-2919, NLM ID: 101631759)*

# Prevalence and Factors Related to Metabolic Syndrome in Xo Dang Patients at Kon Tum General Hospital, Vietnam

**Le Huu Loi [a*], Dinh Thi Van Anh [b], Nguyen Quang Thieu [b], Cao Ba Loi [b], Nguyen Trong Hung [c*], Phan Huong Duong [d]**

*[a] Nguyen Trong Hung, National Institute of Nutrition, Hanoi, Vietnam.*
*[b] National Institute of Malariology Parasitology and Entomology, Hanoi, Vietnam.*
*[c] National Institutue of Nutrition, Hanoi, Vietnam.*
*[d] National Hospital of Endocrinology, Hanoi, Vietnam.*

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***Original Research Article***

## ABSTRACT

**Introduction:** Metabolic syndrome (MetS) is a common disorder and different ethnicities may have different prevalence and related fators. MetS is associated with many chronic diseases and there is a great need for research on MetS in different ethnic groups, especially the communities of ethnic minorities.
**Aim:** The aim of this study is to determine the prevalence and some factors related to MetS among Xo Dang, an ethnic minority group at Kon Tum province.
**Methods:** diagnosis of Mets according to IDF/AHA consensus, comparing the characteristics of 261 patients of Xo Dang with 561 patients of Kinh ethnicity.
**Results:** The rates of habits related to MetS among Xo Dang ethnicity were all higher than 50% and not different from those of Kinh ethnicity. The mean values of waist circumference, maximum and minimum blood pressure, levels of glucose, triglyceride, and HDL-C levels in the blood of the Xo Dang were not significantly different from those of the Kinh ethnicity. The levels of disorders among Xo Dang ethnicity in descending order were increased triglycerides (71.26%), hyperglycemia (42.53%), hypertension (38.31%), increased waist circumference (36.02%), and low HDL-C (26.82%). The rate of increasing waist circumference and the prevalence of MetS in the Xo Dang people was higher than that of the Kinh ethnicity. Xo Dang persons who were female had a higher risk of developing MetS. Smoking was associated with MetS among Kinh ethnicity, however, was not with Xo Dang ethnicity.
**Conclusion:** It seems that the prevalence of metabolic syndrome of Xo Dang people was higher than that Kinh people and the rate of habits related to metabolic syndrome in the Xo Dang people was high.

*Keywords: Metabolic syndrome; ethnicity; related factors.*

## 1. INTRODUCTION

Metabolic syndrome (MetS) is a syndrome that includes many disorders such as obesity,

disorders of glucose and lipid metabolism, and hypertension [1]. Metabolic syndrome is a risk factor for cardiovascular disease, stroke, and a leading cause of death [2,3]. Currently, people ingest more calories than are expended along with a sedentary lifestyle leading to the incidence of MetS is increasing strongly all over the world, especially in developing countries. Metabolic syndrome is associated with many chronic diseases and is one of the most concerned non-communicable diseases in the world and in Vietnam [4]. The pathogenesis is unclear and under investigation. Most people affected by the condition are older, obese, sedentary, psychosocial stress and have a degree of insulin resistance. The risk factors are diet (particularly sugar-sweetened beverage consumption) [5], genetics [6,7,8,9], aging, sedentary behavior or low physical activity [10,11,12], short sleep [13], mood disorders/psychotropic medication use and excessive alcohol use [14,15].

According to global survey of obesity in 195 countries in 2015, a total of 107.7 million children and 603.7 million adults were obese. Since 1980, the prevalence of obesity has doubled in more than 70 countries and has continuously increased in most other countries. Although the prevalence of obesity among children has been lower than that among adults, the rate of increase in childhood obesity in many countries has been greater than the rate of increase in adult obesity. High BMI accounted for 4.0 million deaths globally, more than two thirds of deaths related to high BMI which were due to cardiovascular disease [16]. According to US CDC data published in 2017, about 12.2% of adults have type 2 diabetes (T2DM). The prevalence of T2DM increases with age, reaching as high as 25.2% in the elderly (65 years and older). Rates of prediabetes or MetS are about three times higher. So about one-third of adults in the United States have metabolic syndrome [17]. In China, between 1992 and 2002, the prevalence of overweight and obesity increased in all gender and age groups and in all geographic areas. The prevalence of overweight and obesity increased from 14.6% to 21.8%. The prevalence of hypertension, dyslipidaemia, metabolic syndrome, and diabetes among Chinese adults was approximately 20%, 20%, 15% and 3%, respectively. The mortality rate of 'nutrition, endocrinology and metabolism-related disease' (NEMD) went up in both rural and urban areas between 1990 and 2000, 8.0 to 10.6 and 4.9 to 5.3, respectively [18].

In Vietnam, there have been a number of studies on MetS, mainly on Kinh communities in big cities, in the northern or southern delta regions [19,20]. Studies in ethnic minority communities are few [21,22]. With the upward trend of malpractice in the world and in Vietnam recently, there is a great need for studies on MetS in different ethnic groups, especially the communities of ethnic minorities. We have conducted this study with the aim of determining the prevalence and some factors related to metabolic syndrome in the Xo Dang community, one of the ethnic minorities who have long settled in Kon Tum, a mountainous province in the North Highlands region.

## 2. MATERIALS AND METHODS

### 2.1 Research Subjects

Xo Dang and Kinh people aged 18 years or older, visiting the Department of Examination-General Hospital of Kon Tum province during the research period (from April 2018 to August 2019), volunteering to participate in the study (signing consent form).

### 2.2 Criteria for Diagnosis of Mets and Assessing Habits

- *Criteria for diagnosis of MetS*

According to the IDF/AHA consensus (2009) when at least 3/5 of the following criteria are present [23]:

- High waist circumference (waist circumference ≥90 cm for men, ≥80 cm for women).
- Hypertriglyceridemia: triglycerides ≥1.7mmol/L or being treated with medications to increase triglycerides;
- Lowering high-density lipoprotein cholesterol (HDL-C): blood HDL-C <1.0 mmol/L (men) or <1.3 mmol/L (women) or taking medication to lower HDL-C;
- Hypertension (BP): Systolic blood pressure ≥130 mmHg and/or diastolic blood pressure ≥85 mmHg; or are taking medication for high blood pressure.
- Fasting hyperglycemia: blood glucose ≥100mg/dL (5.6 mmol/L) or being treated with antidiabetic drugs.

- Some criteria for assessing habits

- Eating salty: assessment is based on the subjectivity of the interviewee, compared with those around.
- High-fat diet: based on the frequency of eating fried, stir-fried and grilled dishes during the week. Fat calories percentage of actual dietary intake > 30% of total energy intake per day [24].
- Diet rich in fiber: based on the frequency and volume of vegetables and fruits. Eating at least 400 g, of fruit and vegetables per day [24].
- Use of alcohol, alcoholic beverages, do not drink alcohol when: men drink ≤ 2 glasses of wine (300 ml of wine)/day or 2 ≤ cans of beer (≤14 cans/week); females drink ≤ 1 glass of wine (150 ml of alcohol)/day or ≤ 1 can [23].
- Sedentary lifestyle: those who are physically active, do moderate intensity exercise <30 minutes/day or high intensity <20 minutes/day x 3 days/week [25].
- Smoking habit: Smoking habit were classified as following three conditions: non-smoking, occasional smoking, and daily smoking. For statistical purposes, patients who smoked occasionally or daily were classified as patients who smoked.

## 2.3 Study Design

- Cross-sectional description.
- *Sample size:* Apply sample size to proportional survey

$$n=Z^2_{1-\alpha/2}\frac{p(1-p)}{d^2}$$

with p (estimated incidence of MetS) = 19.6% [26], $\alpha$ (statistical significance level) = 95%; Z=1.96; d (desired precision)= 0.05, n (minimum number of samples) = 243. We actually surveyed 261 people from Xo Dang. To have comparative data, we conducted a survey on 561 Kinh people who came to the clinic in the same time frame of the study (control group, 2/1 approximate ratio).

- *Techniques used in the study*

- Interview: demographic information, habits according to the questionnaire.
- Measure waist circumference, blood pressure: according to routine techniques.
- Test biochemical indicators: take 3 ml of venous blood in the morning, when fasting. Quantitative tests for triglycerides, HDL-C, and blood glucose were conducted on an automatic biochemical testing machine at the Laboratory Department, Kon Tum General Hospital.

## 2.4 Data Analysis

Using SPSS 20.0 software, using routine biomedical statistical analysis. Continuous and discrete variables were presented with mean and ± SD, and number and percentage, respectively. Chi-square analyses were used to test the difference between biochemical variables between the two groups. Multiple logistic regression analysis was used to examine associations between risk factors of metabolic syndrome and sociodemographic factors as independent and dependent variables, respectively. Adjusted odds ratio and 95% confidence intervals were calculated for all metabolic syndrome parameters. P-values less than 0.05 were regarded as statistically significant.

## 3. RESULTS

Our study was conducted with the participation of 261 patients of Xo Dang ethnic group and 561 patients of Kinh ethnic group. the characteristics of Xo Dang patients are similar to Kinh patients, except that the education level is lower and manual labor accounts for a higher proportion (Table 1).

**Table 1. Demographic characteristics of research subjects**

| **Characteristics** | | **Xo Dang (n=261)** | **Kinh (n=561)** | ***P*** |
|---|---|---|---|---|
| Age (year) | $\bar{X}$±SD | 54.75 ± 16.71 | 52.96 ± 16.95 | *0.16* |
| Gender | Male (n, %) | 178 (68.20) | 386 (68.81) | *0.87* |
| | Female (n, %) | 83 (31.80) | 175 (31.19) | |
| Education level | ≤ High school (n, %) | 135 (51.72) | 228 (40.64) | *0.003* |
| | > High school (n, %) | 126 (48.28) | 333 (59.36) | |
| Occupation | Mental labour (n, %) | 64 (24.52) | 196 (34.94) | *0.003* |

| | | | | |
|---|---|---|---|---|
| | Manual labour (n, %) | 197 (75.48) | 365 (65.06) | |
| Accommodation | Urban (n, %) | 163 (62.45) | 350 (62.39) | *1.000* |
| | Rural (n, %) | 98 (37.55) | 211 (37.61) | |
| Marital status | Single (n, %) | 59 (22.61) | 129 (23.00) | *0.94* |
| | Married (n, %) | 202 (77.39) | 432 (77.00) | |

**Table 2. Habitual characteristics of research subjects**

| **Habits** | **Xo Dang (n=261)** | | **Kinh (n=561)** | | ***P*** |
|---|---|---|---|---|---|
| | **n** | **%** | **n** | **%** | |
| Eating salty foods | 158 | 60.54 | 355 | 63.28 | *0.49* |
| Eating a lot of fat | 132 | 50.57 | 283 | 50.45 | *1.000* |
| Eating less fiber | 159 | 60.92 | 339 | 60.43 | *0.94* |
| Smoking | 131 | 50.19 | 252 | 44.92 | *0.18* |
| Drinking alcohol, beer | 142 | 54.41 | 299 | 53.30 | *0.82* |
| Sedentary | 144 | 55.17 | 319 | 56.86 | *0.65* |

**Table 3. Average values of metabolic syndrome components**

| **Characteristics** | **Xo Dang (n=261)** | **Kinh (n=561)** | ***P*** |
|---|---|---|---|
| Waist circumference (cm) | 84.90 ± 7.97 | 84.12 ± 8,52 | *0.22* |
| Systolic pressure (mm Hg) | 125.07 ± 11.47 | 124.49 ± 11.99 | *0.51* |
| Diastolic pressure (mm Hg) | 79.28 ± 7.36 | 80.05 ± 6.93 | *0.14* |
| Blood glucose (mmol/L) | 5.93 ± 1.27 | 5.76 ± 1.15 | *0.06* |
| Triglyceride (mmol/L) | 2.47 ± 1.43 | 2.53 ± 1.70 | *0.57* |
| HDL -C (mmol/L) | 1.34 ± 0.46 | 1.35 ± 0.41 | *0.78* |

**Table 4. Abnormal prevalence of components of metabolic syndrome**

| **Ingredient** | **Xo Dang (n=261)** | | **Kinh (n=561)** | | **OR (CI 95%)** | ***P*** |
|---|---|---|---|---|---|---|
| | **n** | **%** | **n** | **%** | | |
| High waist circumference | 94 | 36.02 | 153 | 27.27 | 1.50 (1.10 – 2.05) | 0.01 |
| Hypertension | 100 | 38.31 | 198 | 35.29 | 1.14 (0.84-1.54) | 0.44 |
| High blood glucose | 111 | 42.53 | 205 | 36.54 | 1.29 (0.95-1.73) | 0.12 |
| High triglyceride | 186 | 71.26 | 373 | 66.49 | 1.25 (0.91-1.72) | 0.20 |
| Low HDL-C | 70 | 26.82 | 124 | 22.10 | 1.29 (0.92-1.81) | 0.16 |
| MetS | 72 | 27.59 | 110 | 19.61 | 1.56 (1.11-2.20) | 0.01 |

**Table 5. Factors associated with metabolic syndrome**

| Characteristics | Xo Dang | | | | Kinh | | | |
|---|---|---|---|---|---|---|---|---|
| | Single variate analysis | | Multi variate analysis | | Single variate analysis | | Multi variate analysis | |
| | OR (CI 95%) | *P* | OR (CI 95%) | *P* | OR (CI 95%) | *P* | OR (CI 95%) | *P* |
| Age (>60y) | 1.66 (0.96-2.87) | 0.09 | | | 1.18 (0.77-1.82) | 0.50 | | |
| Gender (Female) | 1.99 (1.13-3.51) | 0.02 | 3.41 (1.76-6,61) | *0.000* | 1.98 (1.29) | 0.003 | 15.72 (7.09 – 34.83) | *0.000* |
| Education level | 0.62 (0.36-1.07) | 0.10 | | | 1.01 (0.66-1.55) | 1.000 | | |
| Occupation | 0.60 (0.30-1.18) | 0.15 | | | 0.79 (0.51-1.25) | 0.37 | | |
| Accommodation | 1.53 (0.86-2.73) | 0.16 | | | 0.73 (0.48-1.12) | 0.16 | | |
| Marital status | 0.87 (0.45-1.68) | 0.74 | | | 1.05 (0.64-1.71) | 0.900 | | |
| Eating salty foods | 0.59 (0.34-1.03) | 0.07 | | | 1.02 (0.66-1.57) | 1.000 | | |
| Eating a lot of fat | 1.67 (0.96-2.89) | 0.07 | | | 2.50 (1.61-3.89) | 0.000 | 1.44 (0.85-2.44) | *0.18* |
| Eating less fiber | 1.53 (0.86-2.72) | 0.16 | | | 1.59 (1.02-2.49) | 0.04 | 0.71 (0.40-1.25) | *0.23* |
| Smoking | 1.46 (0.84-2.51) | 0.21 | | | 2.72 (1.76-4.19) | 0.000 | 8.41 (4.04-17.52) | *0.000* |
| Drinking alcohol, beer | 2.86 (1.59-5.16) | 0.000 | 4.39 (2.24-8.62) | *0.000* | 3.77 (2.32-6.10) | 0.000 | 6.35 (3.31-12.19) | *0.000* |
| Sedentary | 1.02 (0.59-1.76) | 1.000 | | | 0.81 (0.53-1.23) | 0.34 | | |

Habitual characteristics of research subjects were showed in Table 2. The prevalence of MetS related habits was high (eating salty foods, eating a lot of fat, eating less fiber, drinking alcohol, and being less physically active) and did not differ between the Xo Dang and the Kinh people.

Table 3 indicated that the average value of indicators of the MetS did not differ between the Xo Dang and the Kinh people.

Abnormal prevalence of components of metabolic syndrome of research subjects was showed in Table 4. Compared with the Kinh people, the Xo Dang people have a higher rate of waist circumference and a higher incidence of MetS. The prevalence of hypertension and biochemical disorders of MetS was not significantly different from that of Kinh people.

Factors associated with metabolic syndrome of research subjects were showed in Table 5; single variate analysis results show that there are 2 factors related to MetS in the Xo Dang people, 5 factors related to MetS in the Kinh people. Multivariate analysis found that female and alcoholic drinkers of Xo Dang people had a higher risk of MetS than the Kinh people. Smoking was associated with MetS in Kinh people, however, it did not affect the risk of MetS in Xo Dang people.

## 4. DISCUSSION

In this study, we compare the different characteristics of the MetS between the Kinh people, who settled in the Central Highlands (Kon Tum), and the Xo Dang people, long-time residents in Truong Son - Central Highlands and the mountainous vicinity of Quang Nam, Quang Ngai, can be considered indigenous to Kon Tum. The ratio of Kinh/Xo Dang people participating in the study was 2.15; almost equivalent to this rate in the whole province of Kon Tum 2017 (1.94).

The results of the investigation showed that the Xo Dang patients who visited Kon Tum General Hospital had many habits that were considered bad for their health. However, compared with Kinh people who come to the doctor at the same time, the rate of these habits was not different. In Vietnam, there have not been many studies comparing the indicators of MetS in different ethnic groups. The blood pressure index of the Xo Dang people in our study was equivalent to the previous study in Kon Tum (maximum blood pressure 124±19.7mmHg, minimum blood pressure 78±9.2mmHg) [21]. Comparison between ethnic groups in Kon Tum, A previous research showed that the blood pressure of the Xo Dang was similar to that of the Bah Nar people and Jo Rai people, but higher than that of the Ro Ngao people, but the author has not compared it with the Kinh [28]. The results of our study did not identify any difference in the mean values of the indicators of MetS in the Xo Dang and the Kinh. In some other countries, there are studies showing that the values of the indicators of MetS differ among different ethnic groups [28,29].

The highest rates of elevated triglycerides, both in the Xo Dang and the Kinh, are consistent with a community study in Ho Chi Minh City that found the most common abnormality was elevated triglycerides [19]. In this study, the rate of hyperglycemia was also very high. People living in the Central Highlands have a low prevalence of diabetes, however, according to the general trend of Vietnam, the prevalence of diabetes tends to increase rapidly [21]. Prevalence of component disorders may vary by region. Research results in the North and the South of Vietnam found that the most common component disorders were increased triglycerides, decreased HDL-C, increased blood pressure and increased glucose [19,20]. Unlike studies in the North and the South of Vietnam, cholesterol disorders in both Xo Dang and Kinh people are less common than with other disorders. Not much is known about this phenomenon, but a study in Ecuador showed that people living in high mountains have less cholesterol disorders than people living in low areas [30]. The percentage of people with high blood glucose was not significantly different between the two ethnic groups. In Bac Kan, Le Quang Minh et al. found that Kinh people have a higher prevalence of diabetes than other ethnic minorities (Tay, Nung, Dao) [22]. These results suggest that it is important to have information about metabolic disorders in different human populations.

The proportion of Xo Dang people (indigenous people) with MetS was 27.59%, significantly higher than the rate of 19.61% among Kinh people (migrants from other places). However, we did not find any risk factors (eating habits, lifestyle) that clearly affect this difference, which is also an open question for us to conduct future studies. This result is slightly different from the Canadian study that found the incidence of MetS was lower in Indigenous peoples than in other ethnicities (13.5% among Inuit (Aborigines) and

30% among non-Aboriginal Canadian subjects) [31] Differences in the prevalence of MetS among ethnic groups were also noted in some other studies. 6.17%, Chinese people of Korean descent have the highest risk (OR=5.99), followed by Hui people (OR=4.02), Han people (OR=2.98), Miao, Tujia, Li, Mongolia [29] The higher prevalence of MetS in the Chinese population may be associated with a higher waist circumference, consistent with a study in China. Xuzhen Qin et al. (2020) found that people of Korean descent, the Hui people are the ethnic groups with the highest rate of waist circumference and also have the highest prevalence of MetS, whereas the Tibetans have a very low rate of increased waist circumference and MetS [32].

In addition to the difference in the incidence of MetS, some studies have also found that the impact of related factors also varies between ethnic groups. Research in Suriname shows that a high level of education is a protective factor for Hindustani, but not for Amerindians, Creoles, Javanese, Maroons; People living in rural areas have a lower risk of MetS, however, there is no association between residence and MetS in Amerindians, Creoles, Javanese, Maroons, Hindustani [27]. Our study showed that there were two factors related to the risk of MetS in both Xo Dang and Kinh people who were female and alcohol drinker. Some studies at home and abroad also found that in women [20,24], drinking alcohol is associated with an increased risk of MetS [33,34]. The difference noted in this study was the effect of smoking on MetS. Smoking was associated with MetS in the Kinh but had little effect on the Xo Dang population, even in univariate analysis. Cigarette smoking is considered to be associated with MetS, however, in China, smoking has not been found to be associated with MetS in all studied ethnic groups [32]. Yinxia Su et al (2020) studied 9,745,640 Chinese adults and found the lowest prevalence of MetS among Kyrgyz, Kazak and Mongol ethnic groups with a high rate of bad habits (smoking, drinking, etc.) alcohol, less physical activity) highest. The authors suggested that the genetic background of some ethnic groups may play an important role in the risk of MetS, even though they have many habits that are considered risk factors for MetS [6]. It was also possible that the effect of different factors on different ethnicity. A study in the US found that smoking had a greater effect on lower HDL-C levels in African-Americans than in white Americans [35]. In our study, the level of smoking has not been quantified, an important factor affecting the impact of smoking on the risk of MetS [36].

## 5. CONCLUSION

The results of the study comparing the characteristics of 261 Xo Dang patients with 561 Kinh patients visiting Kon Tum General Hospital showed that the rate of habits related to metabolic syndrome in the Xo Dang people was over 50%. The prevalence of metabolic syndrome of Xo Dang people was higher than Kinh people.

## CONSENT AND ETHICAL APPROVAL

The study protocol was approved by the Research Ethics and Detailed Protocol Review Board of the National Institute of Malaria - Parasites - Entomology (number of decision councils: No. 266/QD-VSR, 2018 March 13). All patients gave their informed consent for the publication of this study.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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