LE HUU LOI

**RESEARCH ON THE SITUATION OF THE
METABOLIC SYNDROME. SOME RELATED
FACTORS AND EFFECTIVENESS OF
INTERVENTIONS IN PATIENTS AT KON TUM
HOSPITAL (2018 - 2020)**

Major: Epidemiology
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SUMMARY OF MEDICAL Ph.D THESIS

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Promotors:

    1. Promotor 1: PhD. NGUYEN QUANG THIEU

    2. Promotor 2: PhD. PHAN HUONG DUONG

      Opponent 1:

      Opponent 2:

      Opponent 3:

The thesis will be defended before the academy-level doctoral thesis quality examination council in National Institute of Malariology - Parasitology and Entomology at ...

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INTRODUCTION

Noncommunicable diseases are one of the most causes of death globally. In the period 1990-2010, the burden of infectious diseases decreased from 45.6% to 20.8%, however, the burden of non-communicable diseases increased from 42% to 66%. According to the World Health Organization, by 2020, the mortality rate from non-communicable diseases increase to about 44 million people in the world, in Southeast Asia area, it has about 10.4 million of cases [1].

Metabolic syndrome is a cluster of metabolic abnormalities, including many risk factors that have been identified by the Ministry of Health to control and reduce the burden of disease, the prevalence of metabolic syndrome was 10% - 84% depending on region, gender, age, race [3], [4], Results of many studies in Northern Vietnam found that the prevalence of metabolic syndrome in the 55-64 age group was up to 27% [6].

In Kon Tum, a research in 2017 on metabolic syndrome in senior officials showed that the prevalence of metabolic syndrome was 27% [7]. Up to now, there had not been a comprehensive study to evaluate clinical and subclinical indicators, factors related to the syndrome as well as interventions in which lifestyle changes were appropriate to enhance treatment effectiveness.

To the necessary of the diagnosis and treatment of metabolic syndrome in Kon Tum, we study this thesis "Research on the situation of the metabolic syndrome, some related factors and the effectiveness of interventions in patients at Kon Tum Hospital (2018 - 2020)", for the following goals:

1. Describe the situation of metabolic syndrome and some related factors in patients who come for examination and treatment at Kon Tum Hospital (2018 - 2019);

2. Evaluate the effectiveness of therapeutic interventions combined with communication, education to change behavior, lifestyle for metabolic syndrome patients.

STRUCTURE OF THESIS

The thesis covers 130 pages. including: Introduction with 2 pages; Overview with 35 pages; Researching objects and methods with 24 pages; Researching findings with 34 pages; Discussion with 32 pages; Conclusion with 2 pages; Request with 1 page. The thesis has 7 figures, 49 tables. There are 170 references. in which 69/170 documents have been published for 5 recent years.

SCIENTIFICNESS AND NOVELTY OF TOPIC

1. This thesis is the first research project carried out meticulously and intensively in Kon Tum province on metabolic syndrome, with a scientific theoretical basis and verified by practice on patients coming to Kon Tum Hospital for examination, the thesis clarified the pathology of the metabolic syndrome at the Kon Tum Hospital and the effectiveness of intervention for the components of the metabolic syndrome, the most difficult components to improve of the metabolic syndrome.

2. Research on the situation of the metabolic syndrome at Kon Tum Hospital, the results of intervention to metabolic syndrome patients, evaluate the effectiveness indexes of the metabolic syndrome components. The new point of this research is the first time, a cohort study on clinical epidemiological characteristics in metabolic syndrome patients has been applied at Kon Tum Hospital, evaluation of the effectiveness of lifestyle interventions combined with therapeutic interventions, is the basis for the Kon Tum Hospital to prepare human resources and facilities to be able to treat metabolic syndrome patients early as the increase of non-communicable diseases.

3. This research contributes to the publication of data on the epidemiology of metabolic syndrome at Kon Tum Hospital,

as a basis for further research on the epidemiological characteristics of metabolic syndrome in the Central Highlands of Viet Nam, in Viet Nam as well as other international areas.

Chapter 1: OVERVIEW

In 1765, the Italian physician, J.B. Morgagni, discovered the relation of visceral obesity, hypertension, atherosclerosis, elevated uric acid and sleep apnea syndrome [9].

Metabolic syndrome is a pro-inflammatory and pro-atherosclerotic state with proliferation of adipose tissue (currently, it is considered an endocrine gland), and insulin resistance is the major cause of the disease [16].

According to the Joint Interim Statement of the International Diabetes Federation (IDF); National Heart. Lung and Blood Institute (NHLBI); American Heart Assocciation (AHA); World Heart Federation (WHF), International Atherosclerosis Society (IAS) and the International Association for the Study of Obesity if the patient meets 3 of the following 5 criteria to be diagnosed with metabolic syndrome: Elevated waist circumference; Elevated blood pressure; Elevated triglyceride; Reduced HDL-C; Elevated fasting glucose [15].

The results of international research on metabolic syndrome have also noted that there is a difference in the prevalence of metabolic syndrome among ethnic groups, the components of metabolic syndrome and the risk factors of metabolic syndrome, that difference which can be explained in addition to the different factors of ethnic groups living habits. genetic factors also play an important role [24], [25].

Figure 1.1. The prevalence of metabolic syndrome in the world [31]

Studies on metabolic syndrome in Vietnam have also been carried out on many patient groups, in many regions of the country. Research by Dung Thi Pham in 2019 showed that the prevalence of Vietnamese people in rural areas is 19.6% (95% CI: 17.8-21.4), of which female 24.2 % (95% CI: 21.5-26.9), male 14.8% (95% CI: 2.5-17.1). The prevalence of metabolic syndrome was 3.9%-25% in community surveys of different ages [39], [40], [41], [42].

Risk factors in metabolic syndrome include non-modifiable factors (Age, gender, ethnicity) and modifiable factors (Abuse of alcohol, beer, alcoholic beverages - C_2H_5OH; smoking; eating a lot of fat, eating less vegetables, fruits, fiber; obesity; little physical activity; residence).

To prevent metabolic syndrome in the community, the Ministry of Health has issued Decision No. 346/QĐ-BYT dated January/30/2015 on the Promulgation of a Plan for Prevention and Control of No. the period of 2015-2020 and the National Strategy for Prevention and Control of Non-Communicable Diseases for the period of 2015-2025. Preventive interventions for people who have not yet had metabolic syndrome include interventions for healthy people and preventive interventions, for people with 1 component or 2 components of metabolic

syndrome (pre-metabolic syndrome) [6].

Effective methods of metabolic prevention prevention include lifestyle changes, weight loss, diet, exercise and treatment includes the use of appropriate medications to reduce specific risks. Medication therapy should be considered for those whose risk factors have not changed with preventive measures and lifestyle changes [18].

Interventions to reduce the prevalence of metabolic syndrome patients include two methods: non-pharmacological interventions (lifestyle changes), medication therapy, or combination of both. Result of the research about effective combined intervention showed that the incidence of metabolic syndrome was reduced by 39% in intervention group participants compared with control group participants (OR = 0.61; 95% CI 0.38 to 0.96) [96].

Chapter 2: RESEARCHING METHODS

2.1. Researching method of target 1: Describe the situation of metabolic syndrome and some related factors in patients who come for examination and treatment at Kon Tum Hospital (2018 - 2019)

2.1.1. Research subjects: People aged 18 years or older who came to the clinic for medical examination.

Diagnostic criteria for metabolic syndrome:

Criteria for diagnosis of metabolic syndrome: according to the IDF/AHA consensus (2009) when at least 3/5 of the following criteria are present: Elevated waist circumference: (waist circumference ≥ 90 cm to men or ≥ 80 cm to women); Elevated triglycerides ≥ 1.7mmol/L or being treated with dyslipidemia medication; Reduced high-density lipoprotein cholesterol (HDL-C): HDL-C <1.0 mmol/L to men) or <1.3 mmol/L to women or being treated with dyslipidemia medication; Elevated blood pressure: systolic ≥ 130 mmHg and/or diastolic ≥ 85 mmHg or being treated with hypertension medication; Elevated fasting glucose: blood glucose ≥ 100mg/dL

(5.6 mmol/L) or being treated with diabetes medication [3].

2.1.2. Place and time of study

- Research location: Outpatients Department, Kon Tum Hospital.

- Research period: From April 2018 to September 2018.

2.1.3. Researching Methods

- Study design: A cross-sectional descriptive study, analyzing all cases that met the criteria for sampling.

- Sample size: Based on the formula for calculating sample size. estimate a ratio [105], [106]:

$$n = Z^2_{1-\frac{\alpha}{2}} \frac{1-p}{p\varepsilon^2}$$

In which: n = minimum samples size; α = 0.05. so $Z_{1-\alpha/2}$ = 1.96; p = 0.27 [7]; Ɛ relative error. selecting Ɛ = 0.1. With the selected values, the calculated sample size is 1038.66. In fact. the project has performed 1039 people.

2.1.3.3. Sampling method: Patients who come to Outpatients Department of Kon Tum Hospital, fully meet the sampling criteria will be listed. research medical records. and save serum samples. Take up to a sufficient number of study samples.

2.1.4. Research content: Patients come to Outpatients Department of Kon Tum Hospital were examined and tested to determine: Demographic characteristics, the prevalence of metabolic syndrome, describe the clinical and laboratory features in patients with metabolic syndrome.

2.2. Researching method of target 2: Evaluate the effectiveness of therapeutic interventions combined with communication, education to change behavior, lifestyle for metabolic syndrome patients

.2.1. Research subjects

Patients who met the criteria for metabolic syndrome at goal 1, agreed to continue participating in the research, were selected for an intervention research at goal 2.

2.2.2. Place and time of study

- Research location: Outpatients Department of Kon Tum Hospital.
- Research period: From April 2018 to April 2019.

2.2.3. Research Methods

- Study design: Non-controlled intervention study, comparison before and after treatment.
- Sample size and method: All metabolic syndrome patients were identified from goal 1 continued to participate in the intervention research, comparition before and after treatment.

2.2.4. Research content:

- Lifestyle change counseling: Counseling to change the patient's lifestyle: Limit foods with a high glycemic index. Use unsaturated fats, which are abundant in vegetable oils, fish fats.... limit saturated fat and cholesterol. Increase fiber use. Limit salty foods and alcohol, do not smoke. Avoid sedentary lifestyle, increase movement in daily work at work as well as at home. Encourage daily exercise. at least 30 minutes/day of moderate intensity.
- Medication: Medication to metabolic syndrome patients include diabetes medication (oral drugs), hypertension medication, dyslipidemia medication according to the treatment protocol of the Ministry of Health. Combination of lifestyle counseling and medication for patients with metabolic syndrome, nutritional counseling, exercise and medication according to the protocol of the Ministry of Health in the treatment of hypertension, dyslipidemia, diabetes [2], [95], [115].
- Monitor and support patients to adhere to interventions: Monthly, patients were visited to assess the level of treatment adherence, side effects of medication to adjust accordingly. At the 6th month of follow-up, they were examined and tested to assess the effectiveness of the intervention.

2.3. Statistical methods and data analysis

- According to the biomedical statistical method, using the software SPSS 20.0. Test the normal distribution of quantitative variables by Skewness index (deviation) and Kurtosis (hunchback). The proportions were compared using the χ2 test (chi-square test). The mean values between two independent groups were compared using the student t test.

- Calculate risk factors for metabolic syndrome by OR index (Odds Ratio), 95% confidence interval (95% CI). The value of OR >1 and p <0.05 is considered to be statistically significant, if OR <1 and p >0.05 is considered to be statistically significant.

- Comparing the proportions between the two groups before and after treatment by McNemar test, the value of p <0.05 is considered to be statistically significant.

2.5. Control confounding effects and errors

- Before conducting research, researchers must master the order of research procedures; Make sure the minimum sample size required for the sample size calculation; Comply with the principles of screening and selecting qualified people into the research sample. The data were processed and analyzed by suitable statistical tests. Filter data before analysis.

2.6. Ethics in research

- The study was approved by the Medical Ethics Committee of the National Institute of Malaria - Parasitology - Entomology according to Decision No. 2156/QĐ-VSR dated October/20/2017 of the Director of the Institute of Malaria - Parasitology - Central Entomology and the Decision No. 488/QD-BVT dated November/1/2017 of the Director of Kon Tum Hospital.

Chapter 3: RESEARCHING RESULTS

3.1. Describe the situation of metabolic syndrome and some related factors

3.1.2. Prevalence and clinical epidemiological features of metabolic syndrome
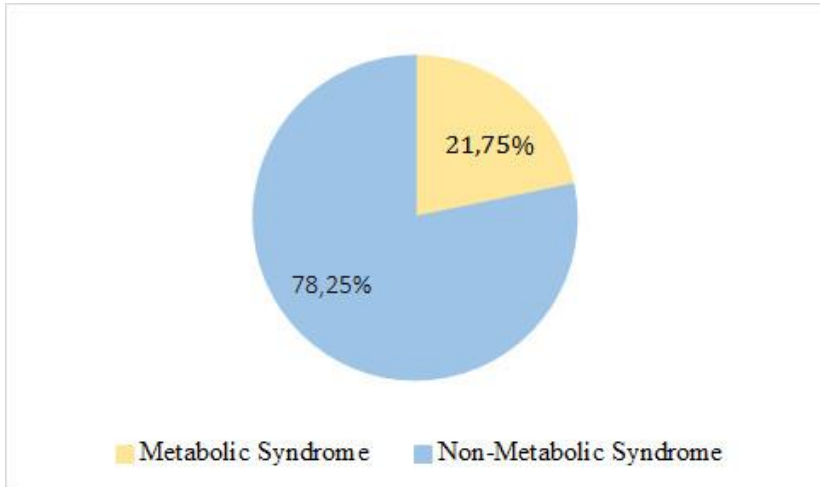
Figure 3.3. Prevalence of metabolic syndrome patients (n=1039)

Remarks: The prevalence of metabolic syndrome in 1039 patients who came to Kon Tum Hospital was 21.75% (226 patients), the youngest age was 19 years old, the highest age was 90 years old, the prevalence of non-metabolic syndrome patients was 78.25% (813 patients).

Table 3.5. The prevalence of metabolic syndrome by age group (n = 1039)

Age group	Metabolic syndrome		Patients (n=1039)	Prevalence (%)	p
	Yes	No			
18 - 29	17	98	115	14.78	
30 - 39	20	99	119	16.81	
40 - 49	42	124	166	25.30	>0.05
50 - 59	51	184	235	21.70	
60 - 69	50	172	222	22.52	
≥ 70	46	136	182	25.27	
Total	**226**	**813**	**1039**	**21.75**	

Remarks: The prevalence of metabolic syndrome is highest in the group of people over 70 years old (26.04%), followed by the age group 41-50 (24.2%), the remaining age groups tend to increase the incidence, metabolic syndrome: the lowest age group ≤ 30 years old (15.32%). group 31-40 accounted for 18.6%. followed by age group 51-60 (21.21%). age group 61-70 (22 years old) .96%). There was no difference in the incidence of metabolic syndrome between age groups.

Table 3.6. Prevalence of metabolic syndrome by ethnic group (n=1039)

Ethnic	Metabolic syndrome	Patients (n=1039)	Prevalence (%)	p
Kinh	110	561	19.61	
Xo Dang	72	261	27.59	
Ba Na	26	127	20.47	0.119
Gie Trieng	16	76	21.05	
Others	2	14	14.29	
Total	**226**	**1039**	**21.75**	

Remarks: The prevalence of metabolic syndrome is 19.61% among the Kinh people, in the Xo Dang ethnic group is 27.59%, in the Ba Na ethnic group is 20.47% and in the Gie Trieng ethnic group is 21.05%; other ethnic groups have the lowest rate of 14.29%. There was no difference in the prevalence of metabolic syndrome among ethnic groups (p > 0.05).
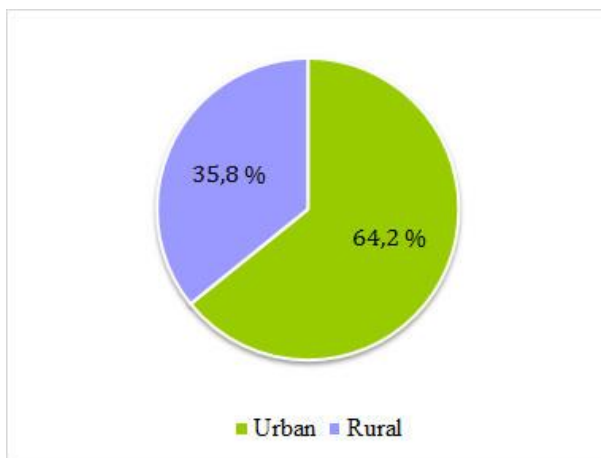
Figure 3.4. Distribution of residence of metabolic syndrome patients (n=226)

Remarks: The percentage of metabolic syndrome patients in urban (64.2%) is higher than in rural (35.8%).

Table 3.9. Number of components and average score of components of metabolic syndrome

Components	Men (n=132)		Women (n=94)		Total (n=226)	
	Number	Ratio (%)	Number	Ratio (%)	Number	Ratio (%)
3	33	25.00	24	25.53	57	25.22
4	67	50.76	36	38.30	103	45.58
5	32	24.24	34	36.17	66	29.20

Average score of components Mean ± SD	3.99 ± 0.70	4.11 ± 0.78	4.04 ± 0.74

Remarks: The rate of metabolic syndrome with 4 components is the highest (45.58%), the metabolic syndrome with 5 components has the rate of 29.2%, the rate of metabolic syndrome with 3 components is the lowest, accounting for 25.22%. The average score of the components of metabolic syndrome is 4.04.

Table 3.10. Mean values of metabolic syndrome components by sex

Components of metabolic syndrome	Men (n$_1$=132)	Women (n$_2$=94)	p	Total (n=226)
	$\bar{X} \pm$ SD	$\bar{X} \pm$ SD		$\bar{X} \pm$ SD
WC[1] (cm)	93.35 ± 2.88	82.70 ± 3.07	<0.05	88.92 ± 6.03
SBP[2] (mmHg)	136.55 ± 14.18	130.31 ± 14.09	<0.05	133.96 ± 14.45
DBP[3] (mmHg)	84.58 ± 8.49	82.55 ± 7.75	>0.05	83.74 ± 8.24
Triglyceride (mmol/L)	3.54 ± 2.21	2.79 ± 1.57	<0.05	3.23 ± 2.00
HDL-C (mmol/L)	1.18 ± 0.41	1.20 ± 0.34	>0.05	1.19 ± 0.38
Glucose (mmol/L)	6.79 ± 1.04	6.59 ± 0.98	>0.05	6.71 ± 1.02

[1]Waist circumference, [2]Systolic blood pressure, [3]Diastolic blood pressure

Remarks: Average value of waist circumference, systolic blood pressure, triglyceride concentration are higher in men than in women. There is no difference between diastolic blood pressure, HDL-C concentration and glucose concentration between men and women.

3.1.3. The influence of risk factors and metabolic syndrome

Table 3.13. Influence of age group and metabolic syndrome

		Metabolic syndrome		Total	OR (95% CI)
		Yes	No		
Age group	> 45	172	533	**705**	1.67 (1.193 - 2.347)
	≤ 45	54	280	**334**	
Total		**226**	**813**	**1039**	

        Remarks: People over 45 years old have a 1.67 times higher risk of metabolic syndrome than people ≤ 45 years old.

        Table 3.14. Influence of **gender and** metabolic syndrome

		Metabolic syndrome		Total	OR (95% CI)
		Yes	No		
Gender	Women	94	229	**323**	1.82 (1.338- 2.465)
	Men	132	584	**716**	
Total		**226**	**813**	**1039**	

        Remarks: Women have a 1.67 times higher risk of metabolic syndrome than men.

        Table 3.26. Multivariate analysis of risk factors and metabolic syndrome

Factors	Univariate analysis OR (95% CI)	Multivariate analysis OR (95% CI)

Age group > 45	1.67 (1.193 - 2.347)	1.32 (0.916 - 1.897)
Sex (Women)	1.82 (1.338 - 2.465)	11.99 (6.806 - 21.145)
Saturated fat and cholesterol use	2.02 (1.485 - 2.742)	1.22 (0.848 - 1.754)
Less fiber use	1.48 (1.084 - 2.012)	0.80 (0.555 - 1.175)
Smoking	2.19 (1.618 - 2.969)	6.49 (3.826 - 11.019)
Drinking	2.87 (2.077 - 3.963)	4.20 (2.732 - 6.472)

Remarks: The results of multivariate analysis showed that risk factors for metabolic syndrome include: Women, smoking and drinking.

3.2. Evaluate the effectiveness of therapeutic interventions combined with communication, education to change behavior, lifestyle for metabolic syndrome patients

During the research period from April 2018 to April 2019, we examined 1039 people at the Outpatients Department of Kon Tum Hospital, we detected 226 metabolic syndrome patients, who were treated with therapeutic interventions combined with communication, education to change behavior, lifestyle for metabolic syndrome patients for 6 months, no patient experienced any side effects during the study. Effective interventions are as follows:

Table 3.33. Effectiveness of intervention to reduce waist circumference (n=214)

	Number of WC patients		WC	
	Number	Ratio (%)	Mean (cm)	SD (cm)
Pre-Intervention	214	94.69	89.45	5.48

Post-Intervention	208	92.04	88.79	7.44
Reducion Index	6	2.65	0.66	
Effectiveness index (%)	2.80		0.74	
p	0.35		<0.05	

[1]Waist circumference

Remarks: The effectiveness of intervention to reduce the rate of people with waist circumference in the group of metabolic syndrome patients is 2.65%, corresponding to 6 patients. The effectiveness index of the intervention to reduce waist circumference was 2.8%, the value of reduction was not statistically significant with $p > 0.05$. After the intervention, the mean waist circumference value of meabolic syndrome patients decreased by 0.66 cm. The efficiency index was 0.74%, statistically significant decrease with $p < 0.05$.

Table 3.34. Effective intervention to reduce the rate of people with hypertension (n=117)

	Hypertension	
	Number	Ratio (%)
Pre-Intervention	177	78.32
Post-Intervention	88	38.94
Reducion Index	79	39.38
Effectiveness index (%)	50.28	
p	<0.05	

Remarks: The effectiveness of interventions to reduce the rate of hypertension in patients with metabolic syndrome is 39.38%. corresponding to 79 patients. The effectiveness index of intervention to reduce hypertension rate was 50.28%, statistically significant decrease with $p < 0.05$.

Table 3.35. Effectiveness of intervention to reduce blood pressure (n=117)

	Mean	SD

		(mm Hg)	(mm Hg)
SBP[1]	Pre-Intervention	133.96	14.45
	Post-Intervention	124.38	10.10
	Reducion Index	9.58	
	Effectiveness index (%)	7.15	
	P	<0.001	
DBP[2]	Pre-Intervention	83.74	8.24
	Post-Intervention	78.93	9.07
	Reducion Index	4.81	
	Effectiveness index (%)	5.74	
	P	0.148	

[1] Systolic blood pressure, [2] Diastolic blood pressure

Remarks: The mean of systolic blood pressure after the intervention decreased by 9.58 mmHg, statistically significant decrease. The effectiveness index of intervention was 7.15%. The mean of diastolic blood pressure decreased by 4.81 mmHg, but not statistically significant decrease.

Table 3.36. Effectiveness of intervention to reduce blood glucose (n=197)

	Number	Ratio (%)	Mean (mmol/L)	SD (mmol/L)
Pre-Intervention	197	87.17	6.71	1.02
Post-Intervention	180	79.65	6.16	0.63
Reducion Index	17	7.52	0.55	
Effectiveness index (%)	8.63		8.20	
p	0.043		<0.001	

Remarks: The effectiveness of intervention to reduce the rate of patients with hyperglycemia was 7.52%, corresponding to 17 patients. The effectiveness index of intervention was 8.63%, statistically significant decrease with p

< 0.05. After the intervention, the mean of blood glucose value decreased by 0.55mmol/L. The effectiveness index of the intervention was 8.20% (p < 0.05).

Table 3.37. Effectiveness of interventions to reduce blood triglyceride (n=209)

	Number	Ratio (%)	Mean (mmol/L)	SD (mmol/L)
Pre-Intervention	209	92.48	3.21	1.95
Post-Intervention	168	74.34	3.00	1.98
Reducion Index	41	18.14	0.21	
Effectiveness index (%)	19.62		6.54	
p	<0.001		0.823	

Remarks: The effectiveness of intervention to reduce the rate of patients with hypertriglyceridemia was 18.14%, corresponding to 41 patients. The effectiveness index of the intervention was 19.62%, statistically significant decrease with p < 0.05. After the intervention, the mean of blood triglycerides decreased by 0.21mmol/L, but not statistically significant decrease.

Table 3.38. Effectiveness of interventions to increase blood triglycerides HDL-C concentration (n=116)

	Number	Ratio (%)	Mean (mmol/L)	SD (mmol/L)
Pre-Intervention	116	51.33	1.19	0.38
Post-Intervention	75	33.19	1.31	0.31
Reducion Index	41	18.14	-0.12	
Effectiveness index (%)	35.34		-10.08	
p	<0.001		<0.001	

Remarks: The effectiveness of interventions to

metabolic syndrome patients with reduced HDL-C was 18.14%, corresponding to 41 patients. The effectiveness index of the intervention was 35.34% ($p < 0.05$). After the intervention, the mean blood HDL-C concentration increased by 0.12 mmol/L. The effectiveness index of the intervention was 10.08%, statistically significant increase with $p < 0.05$.

Table 3.45. Effectiveness of intervention to reduce 3 components of metabolic syndrome (n=57)

		Metabolic syndrome	
		Number	Ratio (%)
Pre-Intervention		57	25.22
Post-Intervention	Constant	22	9.73
	Increase 1 component	5	2.21
	Increase 2 components	0	0.00
	Increase 3 component	25	11.06
	Decrease 2 components	4	1.77
	Decrease 2 components	1	0.44
Effectiveness of the intervention		30	13.27
Reducion Index		27	11.95
p		< 0.05	
Effectiveness index (%)		47.37	

Remarks: After the ineffective intervention, there were 22 patients (9.73%) did not change the component of metabolic syndrome, 5 patients (2.21) increased 1 component, no patient increased 2 components. The number of metabolic syndrome patients remaining due to the intervention was 30 patients (13.27%), of which there were 25 patients (11.06%) reduction of

1 component, 4 patients (1,77%) reduction of 2 components, 1 patient (0.44%) reduction of 3 components.The reduction index after intervention was 27 patients (11.95%), The efficiency index of reducing 3 components of metabolic syndrome was 47.37%.

Table 3.46. Effectiveness of intervention to reduce 4 components of metabolic syndrome (n=103)

		Metabolic syndrome	
		Number	Ratio (%)
Pre-Intervention		103	45.58
Post-Intervention	Constant	26	11.50
	Increase 1 component	10	4.42
	Decrease 1 component	42	18.58
	Decrease 2 components	21	9.29
	Decrease 3 components	4	1.77
	Decrease 4 components	0	0.00
Effectiveness of the intervention		67	29.65
Reducion Index		36	15.93
p		< 0.05	
Effectiveness index (%)		34.95	

Remarks: After the ineffective intervention, there were 26 patients (11.5%) did not change the component of metabolic syndrome, 10 patients (4.42) increased 1 component. The number of metabolic syndrome patients remaining due to the intervention was 67 patients (29.65%), of which there were 42 patients (18.58%) reduction of 1 component, 21 patients (9,29%) reduction of 2 components, 4 patients (1,77%) reduction of 3 components, no patient reduction 4 components of metabolic

syndrome. The reduction index after intervention was 36 patients (15.93%). The efficiency index of reducing 4 components of metabolic syndrome was 34,95%.

Table 3.47. Effectiveness of intervention to reduce 5 components of metabolic syndrome (n=66)

		Metabolic syndrome	
		Number	Ratio (%)
Pre-Intervention		66	29.2
Pre-Intervention	Constant	19	8.41
	Decrease 1 component	21	9.29
	Decrease 2 components	23	10.18
	Decrease 3 components	2	0.88
	Decrease 4 components	1	0.44
	Decrease 4 components	0	0.00
Effectiveness of the intervention		47	20.8
Reducion Index		19	8.41
p		>0.05	
Effectiveness index (%)		28.79	

Remarks: After the ineffective intervention, there were 19 patients (8,41%) did not change the component of metabolic syndrome. The number of metabolic syndrome patients remaining due to the intervention was 47 patients (20.8%), of which there were 21 patients (9.29%) reduction of 1 component, 23 patients (10,18%) reduction of 2 components, 2 patients (0,88%) reduction of 3 components, 1 patients (0,44%) reduction of 4 components, no patient reduction 5 components of metabolic syndrome. The reduction index after intervention was

19 patients (8.41%). The efficiency index of reducing 5 components of metabolic syndrome was 28,79%.

Table 3.48. Effectiveness of interventions to reduce metabolic syndrome (n=226)

	Metabolic syndrome	
	Number	Ratio (%)
Pre-Intervention	226	100%
Post-Intervention	144	63.72
Reducion Index	82	36.28
p	< 0.001	
Effectiveness index (%)	36.28	

Remarks: After intervention, the reduction of metabolic syndrome was 82 patients. The reduction index after intervention was 82 patients (36.28%). The efficiency index of reducing the prevalence of metabolic syndrome was 82 patients (36.28%), statistically significant deccrease with $p < 0.05$.

Chapter 4: DISCUSSION

4.1. Describe the situation of metabolic syndrome and some related factors in patients who come for examination and treatment at Kon Tum Hospital (2018 - 2019)

4.1.2. Epidemiological and clinical features of metabolic syndrome

Among 1039 people come to Kon Tum hospital for examination, there were 226 patients with metabolic syndrome, the prevalence was 21.75%. The prevalence of metabolic syndrome in different subjects is different, even in healthy people such as the pilot also have metabolic syndrome with a rate of 27.21% [117]. The domestic prevalence of metabolic syndrome ranges from 17% to 38.1% [47], [84]. Compared with the prevalence of metabolic syndrome in Ethiopia, the prevalence of metabolic syndrome was 33.79% [35], higher than domestic studies and our study, this difference shows that the prevalence of metabolic syndrome was different in each region of the world, depending on the economic and social

characteristics of each region and life style, so leading to an increase in the components of metabolic syndrome.

According to Dung Thi Pham, prevalence of metabolic syndrome increased gradually by age group, but from ≥80 years old (26.29%) the prevalence of metabolic syndrome decreased, however it was still higher than the age group <70 years old [39]. The results of research by Ho Thi Kim Thanh found that in men, prevalence of metabolic syndrome increased gradually with age [84]. The difference in prevalence of metabolic syndrome in age groups is different, which can explain that in the Central Highlands, some age group may be less interested in healthy eating, living habits such as eating, drinking, smoke, drink more alcohol than in the delta provinces. These results suggest the need for early communication and screening for metabolic syndrome, even in young adults, who are considered less likely to have metabolic syndrome.

Some results of difference studies have shown differences in the prevalence of metabolic syndrome between difference ethnic groups. Research by Jason L. Vassy et al found that there are 8 specific alleles related to metabolic syndrome [125]. Therefore, the prevalence of metabolic syndrome in our study varied among ethnic groups which may be related to the problem of specific alleles in gene fragments depending on ethnic group. Other researches in the world have also noted that there was a difference in the rate of metabolic syndrome among ethnic groups [24], the authors also explain that in addition to the factor of living habits of different ethnic groups, genes also play an important role [25].

In this research, metabolic syndrome with 4 components was the highest prevalence of metabolic syndrome (45.58%). Domestic research mainly has metabolic syndrome with 3 components [4], [118], [130], the results of foreign researchs also recorded the highest rate of metabolic syndrome with 3 components [35], other studies have found the highest rate of

metabolic syndrome with 4 components [131], this difference possibly because our study was conducted in a medical facility where people had health problems easily come to exam, so the prevalence of components was also higher. Research results have different in the proportion of components of metabolic syndrome usually in 3 components or 4 components, the ratio of 5 components is always low, this can also explain the majority of people with metabolic syndrome may already have been self-regulating lifestyle change before medical intervention was needed, metabolic syndrome people with 5 components may have previously failed to self-regulate lifestyle change at home.

4.1.3. Factors associated with metabolic syndrome

The association between age and metabolic syndrome has been documented in many studies. A study in Thua Thien Hue found that the prevalence of metabolic syndrome was higher in the age group ≥ 45 years [42], in Hanoi, the age group > 50 had metabolic syndrome accounted for 66% [120]. Metabolic syndrome affects nearly 50% of Americans' health over age 50 [8]. According to the study of Heng Guo et al, the prevalence of metabolic syndrome in the age group ≥ 45 years was higher than the age group < 45 [138].

The prevalence of metabolic syndrome was higher in women than men in our study, which was consistent with some studies in the North of Viet Nam [4], [39] and in Thua Thien Hue [42]. A study in Ho Chi Minh City found that men had metabolic syndrome earlier than women, but in elderly women, the rate of metabolic syndrome was higher in women than in men [47].

Research by Dung Thi Pham found that risk factors of metabolic syndrome for men were higher than women (OR = 1.8; 95% CI: 1.5-2.3) [39]. Gender factor in metabolic syndrome depends on each study with different results. Premenopausal women often develop peripheral obesity with subcutaneous fat accumulation, while men and postmenopausal women are more likely to develop central obesity or obesity. In particular, "apple-

android" obesity was associated with increased cardiovascular mortality and the development of type 2 diabetes. Visceral adipocytes differ from peripheral adipocytes in their lipolysis activity and their responses to insulin, adrenergic and angiotensin and sex hormone stimulation. Visceral fat is a major source of circulating free fatty acids and cytokines, which were delivered directly via the portal vein to the liver causing insulin resistance and an atherogenic lipid [123].

Results of multivariate analysis showed gender was the strongest factor affecting the risk of metabolic syndrome. Women were nearly 12 times more likely to develop metabolic syndrome than men. The results in our study were consistent with some studies in the North of Vietnam [39], [80]. A study in Ho Chi Minh City, a city of southern Vietnam founded that the influence of gender was dependent on age, men appeared earlier, but in older women, the prevalence of metabolic syndrome in women was higher than in men [47]. Overall the world, the trend of prevalence of metabolic syndrome was higher in women than men [148].

Smoking was a risk factor of metabolic syndrome [47]. Active smoking was significantly associated with an increased risk of metabolic syndrome (RR = 1.26; 95% CI: 1.10 - 1.44) [69], even in pipe smokers [149]. This risk may persist for 20 years after stopping smoking [150]. Some studies had found that smoking had not affected the risk of metabolic syndrome [24].

Low alcohol drinkers were associated with a reduced risk of metabolic syndrome while regular drinkers have an increased risk of metabolic syndrome. Alkerwi Ala'a et al (2009) found that alcohol consumption of less than 40 g/day in men and less than 20 g/day in women resulted in a significant reduction in the incidence of metabolic syndrome [156]. In Korea, women with low alcohol consumption (<15 g/day) were found to have a lower risk of metabolic syndrome [58], the harmful effects of heavy alcohol consumption were attributed to increased plasma

triglycerides and hypertension [64]. According to recommendations of the Ministry of Health in the national strategy to prevent and control non-communicable diseases, we should change behaviors such as smoking, using alcohol at harmful levels, improper nutrition (eating less fruit and vegetables, fat, salty), less physical activity [77]. According to our research, in Kon Tum province, it is necessary to pay attention to change the smoking and drinking behavior of people to prevent metabolic syndrome.

4.3. Evaluating the effectiveness of therapeutic interventions combined with communication, education to change behavior, lifestyle for metabolic syndrome patients

Elevated waist circumference was the top risk factor and one of the criteria for the diagnosis of metabolic syndrome. People with metabolic syndrome was characterized by fat accumulation mainly in the upper body, intraperitoneal (visceral fat) or subcutaneous fat, and waist circumference reduction was the priority goal in management administration [160]. The results of our study about mean waist circumference reduction by 0.83% was consistent with other results in Southeast Asia with the effectiveness index ranging from 0.71 to 4.71% [91]. Some studies on the effectiveness of interventions to reduce waist circumference in Vietnam also had the results relatively low, the mean waist circumference reducing from 1 cm to 1.84 cm [84], [101], [104] and the effectiveness index was from 1.9% to 1.21% [101], [104]. Results of research in Malaysia had the effectiveness of intervention reduced the mean waist circumference was 0.71 cm, this was the lowest mean in 5 components of metabolic syndrome [158]. Research by Min-Kyung Lee et al found that the effectiveness of the intervention after 2 years by dietary intervention and physical activity reduced waist circumference by 8% [142]. The lowest rate of intervention in waist circumference reduction in other components of metabolic syndrome proves that waist

circumference is one of the most difficult components to reduce, requiring persistence and prolonged time to achieve the effect.

The effectiveness index in our study about the proportion of elevated blood pressure patients (50.28%) was higher than the result of study of Nguyen Duc Cong in Ho Chi Minh City (32.31%) [104], and equivalent to the result of research by Ho Thi Kim Thanh in Hai Duong (49.6%) [84]. The result of study by Min-Kyung Lee et al, after 2 years of intervention with diet and physical activity, found that the intervention effectiveness in reducing the rate of elevated blood pressure was 25.4% [143], lower than our study, maybe in our study patients were precribled to treat when lifestyle changes has not been effective.

The results showed that the reduction in blood pressure in this study was mainly a reduction in systolic blood pressure while diastolic blood pressure was insignificantly reduced. Our results were consistent with some studies in Vietnam [101] and Malaysia [158]. There was also a study that found that both systolic blood pressure and diastolic blood pressure decreased statistically, however, diastolic blood pressure decreased less than systolic blood pressure [84].

The effectiveness index of reducing glucose in our study was very low (8.63%), consistent with the study in Phu Tho (13.2%) [103], however, the study in Ho Chi Minh City found that the rate of hyperglycemia did not change significantly [104]. The reduction in blood glucose in this study was 0.55 mmol/L, similar to the reduction when analyzing the results of 10 different studies, the mean glucose level decreased by 0.68 mmol/L [96], and in Hai Duong was 0.86 mmHg [84]. The results of these studies showed that among the biochemical indicators of metabolic syndrome, blood glucose reduction was still the lowest achieved. A study in Korea found that the intervention effect by diet and physical activity reduced the rate of glucose elevation by 46% [144], this was explained by the patients of study in Korea had a high-energy excess diet, so when the

intervention was done, the rate of glucose concentration level quickly reduced.

The study results showed that the intervention reduced the rate of hypertriglyceridemia, the effectiveness index was 19.62%, lower than some other studies in Vietnam. A study in Ho Chi Minh City found that effectiveness index reduced the rate of hypertriglyceridemia (40.22%) [104], study in Phu Tho found a decrease in rate of hypertriglyceridemia by 26.82% [103].

In Hai Duong, the decrease of hypertriglyceridemia was 0.72 mmol/L (p < 0.05) [84] higher than the mean of reduction in triglyceride concentration of this study was 0.21 mmol/L, similar to the results of study by Maria Van Namen et al (2019), found a decrease in triglyceride concentration was 0.2 mmol/L [96]. The study by Patrícia Pozas Saboya et al. (2017) found that the reduction in triglyceride concentration did not differ between placebo group, intervention group or individual intervention [98]. A study in Korea found that the effectiveness of interventions with diet and physical activity reduced the rate of hypertriglyceridemia by 26.5%, higher than our study, we combined medication and lifestyle interventions, but the effect was still lower, this was explained the patients of study in Korea had a high-energy excess diet [144]. The results of study in community intervention in Ha Nam showed that the rate of hypertriglyceridemia after intervention did not change with statistical significance [101].

The results of domestic intervention studies showed that effectiveness index of reduction of elevated HDL-C from 30.66% to 52.71% [103], [104]. The mean HDL-C increased by 0.12 mmol/L, higher than the results of the study in Hai Duong (0.09 mmol/L) [84] but lower than that of a study in Ha Nam (0.42 mmol/L) [101]. Some studies in the world found low efficiency in changing HDL-C levels, a study by Suzana Shahar in Malaysia found that the group of active nutrition intervention group with mean HDL-C concentration of 1.2 ± 0.3 mmol/L,

after 6 months was 1.1 ± 0.2 mmol/L, the difference was not statistically significant [161]. Research in Korea found that the effectiveness of intervention by diet and physical activity was 23.7% reduction in HDL-C rate, lower than our study, in our study the patients were treated by medication and life style change, so may be more effective [144]. In Southeast Asia, the result of many studies on the effectiveness of metabolic syndrome interventions in improving lipid parameters were lower than those of waist circumference or other disorders [91].

The overall effectiveness of reducing the prevalence of metabolic syndrome in this study was 36.28%, lower than the result of study in Phu Tho (39.3%) [102]. It is possible that the research subjects in Phu Tho were civil servants and public employees, so they had a lower age and a more equal education level than the people in Kon Tum in this study. Our effectiveness index was higher than that of Ho Thi Kim Thanh (17.5%) [84]. A study in Ha Nam found that the effectiveness of intervention to reduce the prevalence of metabolic syndrome was 44%, the effectiveness index was 14.79% [101]. Studies in the world had found that the effectiveness index after intervention usually ranges from 39% to 43.32% [96], [167]. Smoking and excessive alcohol consumption were important risk factors for the development of metabolic syndrome and its components, in the study, by the intervention of diet and physical activity, the incidence of metabolic syndrome was reduced by 35.5% after 2 years of intervention [144] Although there were differences in study subjects, all publications showed that the interventions lifestyle changes combined with medication therapy had been effective in reducing metabolic syndrome.

CONCLUSION

1. The situation of metabolic syndrome and some related factors in 1039 patients who come for examination and treatment at Kon Tum Hospital (2018 - 2019)

- The prevalence of metabolic syndrome in patients

visiting Kon Tum Hospital was 21.75%.

- Prevalence of metabolic syndrome in ethnic minorities: Kinh 19.61%, Xo Dang 27.61%, Ba Na 20.47%, Gie Trieng 21.05%; other ethnic minorities 14.29%. The difference in the prevalence of metabolic syndrome was not significantly different between ethnic groups (p > 0.05).

- The risk factors of metabolic syndrome in this study include: being female, smoking, drinking.

2. Evaluate the effectiveness of therapeutic interventions combined with communication and education to change behavior and lifestyle for 226 metabolic syndrome patients

- The effectiveness index of intervention to reduce the rate of habits: Eating salty (39.53%), eating a lot of fat (35.14%), eating less fiber (34.67%), smoking (24.65%), drinking (13.94%), sedentary (64.29%).

- Effectiveness of intervention to reduce the incidence of metabolic syndrome was 36.28% (p<0.05), the index of intervention effectiveness to reduce the proportion of components of metabolic syndrome: reduction of 3 components was 47.37% (p<0.05), the reduction of 4 components was 34.95% (p<0.05), the reduction of 5 components was 28.79% (p>0.05).

REQUEST

1. Attention should be paid to the habitual risk factors that increase the incidence of metabolic syndrome in clinical practice: alcohol consumption, smoking. Especially, noticed women, smoking, drinking alcohol.

2. Pay attention to the following risk factors: waist circumference, diastolic blood pressure, triglyceride.

LIST OF THESIS-RELATED PUBLICATIONS
OF THE AUTHOR

1. Le Huu Loi. Dinh Thị Van Anh. Nguyen Quang Thieu. Cao Ba Loi. Nguyen Trong Hung. Phan Huong Duong (2021). Prevalence and Factors Related to Metabolic Syndrome in Xo Dang Patients at Kon Tum General Hospital. Vietnam. *Journal of Pharmaceutical Research International*. Vol.33(60B). pp.2258-2266.

2. Le Huu Loi. Nguyen Quang Thieu. Cao Ba Loi. Nguyen Trong Hung. Dinh Thi Van Anh. Phan Huong Duong (2022). Effect of Nutrition Intervention on the Prevalence of Metabolic Syndrome at Kon Tum General Hospital. Vietnam. *Journal of Complementary Medicine Research*. Vol.13(2). pp.2-5.

3. Le Huu Loi, Nguyen Quang Thieu, Phan Huong Duong (2022). "Dac diem hoi chung chuyen hoa o benh nhan den kham tai Benh vien da khoa tinh Kon Tum (4/2018-4/2019)". *Journal of clinical medicine Hue Central Hospital*. Vol 76. pp.78-84.

4. Le Huu Loi, Nguyen Quang Thieu, Cao Ba Loi, Phan Huong Duong (2022) "Ty le va cac dac diem cua hoi chung chuyen hoa o benh nhan dong bao dan toc thieu so nguoi Xo Dang den kham tai Benh vien da khoa tinh Kon Tum". *Journal of Military Pharmaco - Medicine*. Vol 47(2). pp. 47-54.