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Contents

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Special Article Open Access

Emerging Global Health Challenges and Integrated Health Models

Bruce A. Wilcox PhD.[1,*]

[1]*ASEAN Institute for Health Development, Mahidol University, Nakon Pathom, THAILAND*

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*Corresponding author: Prof. Bruce A. Wilcox PhD., ASEAN Institute for Health Development, Mahidol University, 999 Salaya Phuttamonthon, Nakon Pathom 73170 THAILAND

e-mail: wilcox.bru@mahidol.ac.th

ABSTRACT

Despite the achievements of modern biomedicine and public health in reducing disease incidence and improving human well-being globally, emerging infectious diseases, and more recently, emerging chronic and degenerative diseases are reversing these gains. New models and intervention approaches are needed that go beyond those of conventional biomedical and public health thinking and intervention approaches typically narrowly framed on the basis of reductionist models of health. This paper reviews the application of the ecological perspective in public health and associated systems ecological-oriented frameworks for addressing these emerging disease crises. Their utility as a means of integrative research and interventions that combine biomedical, social and environmental dimensions of health is increasingly being demonstrated. The social-ecological systems framework, which only relatively recently has begun to be applied in health science and practice, is particularly promising.

Introduction

Modern biomedicine and public health have contributed remarkable achievements to human well-being, especially in terms of contributing to the reduction of infectious diseases worldwide. This has included the eradication of dreaded diseases such as smallpox and the control of common childhood diseases (polio, measles, rubella, etc.) that once claimed millions of lives and caused suffering of tens of millions. This was made possible through improved diagnostics, surveillance, therapeutics, vaccines and an associated modern health system infrastructure.

These spectacular advances in health sciences during the first half of the last century are largely a result of the emergence and widespread acceptance of the biomedical paradigm in which the discovery of microbes and establishment of 'germ theory' played a central role. By the late 1960's it was widely believed that infectious diseases had been conquered, or were at least conquerable in the case of malaria, dengue and other vector borne diseases (VBD) that appeared to be in retreat.

This confidence, together with a shift in attention to emerging chronic diseases toward the end of the last Century, resulted the diversion of funding away from field and ecologically oriented VBD research, training, and control campaigns. This, and the enthusiasm for laboratory and clinically oriented programs fueled by the continuing stream of breakthroughs in molecular biology-based technologies, largely collapsed what had been a more rationally balanced set of approaches in medicine and public health.

Yet, by the 1980's the HIV/AIDS pandemic followed by the appearance of new antimicrobial resistant strains of bacterial pathogens confidence that infectious diseases had been conquered began to erode. Major setbacks also increasingly became apparent in the efforts to control vector-borne diseases (VBDs), particularly with the resurgence of malaria and dengue fever worldwide.

Subsequently, entirely new diseases of wildlife origin like HIV/AIDS, SARS, NIPA, Highly Pathogenic Avian Influenza (HPAI/H5N1), and Ebola took the biomedical science and public health communities by surprise. Remaining in the background were, and still are, numerous neglected tropical diseases, most of them zoonoses or VBDs, the control of which remains challenging.

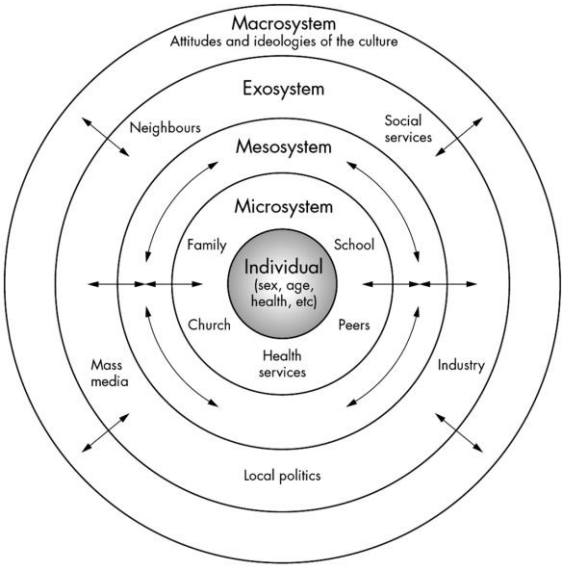
Formal recognition of 'emerging infectious diseases' (EID) as a new category of microbes (newly identified variants and re-surging or re-emerging pathogens as well as antimicrobial resistant strains) came in the early 1990's [1]. Along with it came a realization that despite the power and authority it had deservedly gained the modern biomedical paradigm by itself may be insufficient. In fact, a strict interpretation of germ theory's 'Koch's Postulates' not only has undergone revision [2], but the idea of microbes as 'bad' and typically a threat to health has been challenged [3].

Human population growth and human-caused environmental changes accelerating with an unprecedented intensity and scale particularly since the mid-1900's is recognized as underlying cause of much of the EID problem [4]. These disease emergence drivers are emblematic of the era of modern development and can be seen as an extension of modern medical and hygiene interventions introduced a century earlier [5]. Together they radically modified (and continue alter) landscapes and ecosystems worldwide producing what has become a continual state of social, ecological and evolutionary imbalance [6].

Here I discuss how this global health challenge has helped focus attention on the need for rethinking the infectious disease research agenda, by integrating biomedical, social, and environmental sciences, employing ecological perspectives. I conclude with a discussion of how this may also apply to chronic and degenerative diseases whose incidence has been dramatically increasing worldwide.

Beyond reductionist models in the health sciences

The biomedical and behavioral sciences' application of ecological perspectives in the form of social ecology to public health interventions [7,8], acknowledges the critically important role of people's interactions with their physical and socio-cultural surroundings. These models borrowed from biological ecology the multilevel conception of nature, which in biological is expressed in the form of 'levels of organization hierarchy'—from cells to ecosystems and ultimately the ecosphere [9]. This conception of nature forms the central idea in ecology as an integrative science [10].



The complexity of factors and processes that underly infectious diseases, especially the transmission systems of zoonoses and VBDs, go well beyond the scope and analytic resolution of biomedical science (especially conventional medical training), and even conventional public health (e.g., epidemiology, hygiene and sanitation, etc.). Besides human behavior these factors include human ecology, pathogen/parasite and vector ecology and evolution, as well as the processes of the ecosystems of which the hosts and parasites are components [11,12]. The case of the Liver Fluke as the purported cause of relatively high liver cancer incidence in Northeast Thailand demonstrates how ignoring this complexity may actually undermine rather than support a public health campaign [13].

How this complexity can better be understood, including as a basis for more effective infectious disease interventions, drew attention to the idea of 'social-ecological systems' as new way of framing the global emerging infectious disease problem. This new way of framing disease problems first received attention of health scientists at a meeting associated with the United States National Institutes of Health Roadmap for the Future initiative more than a decade ago [14]. The social-ecological systems framework grew out of an area of research that originated in in the field of systems ecology. It developed over a period of several decades, maturing a little over decade ago [15]. It can be seen an extension of ecological perspectives first employed in the health sciences, such as that illustrated in Figure 1. However, this and other early ecological models were developed prior to the recognition of EIDs, the newly emerging chronic and degenerative diseases, and the environmental changes occurring in parallel with them on a global scale.

The recently adopted Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development represent a big step forward in recognizing the need to address the linkages between health, environment, and development. It is inescapable that an ecological systems-based approach, such as that offered by the social-ecological systems framework, is required to simultaneously address the roles of poverty, inequality and vulnerability in relation to global health challenges [17]. Figure 2 illustrates the more recent conceptualization of the breadth of factors that interact to affect health from a social-ecological systems perspective.

Ecology and rural health in Southeast Asia and beyond

Social-ecological systems framing of health is particularly relevant to health in rural areas. The health of individuals and communities in rural environments

Figure 1. This diagram of McClaren and Hawe [16] illustrates the linkages between the numerous factors in the environment that influence an individual's life course including vulnerability to disease based on Bronfenbrenner's ecology of human development framework. This includes linkages between settings that a person may or may not be directly exposed to, but that are nonetheless important as they impact a person's immediate environment.

is more immediately dependent on nature and natural resources, as indicated in Figure 2, than is the case for urban dwellers. Rural people also are more directly exposed to the negative affects of the degradation of these resources currently taking place at an alarming nearly everywhere in the world.

taking place throughout the developing world. Chronic psychosocial stress also is associated with behavioral changes that predispose to cancer such as increasing alcohol consumption, which, for example, has reportedly grown several-fold in Thailand since the 1960's [20].

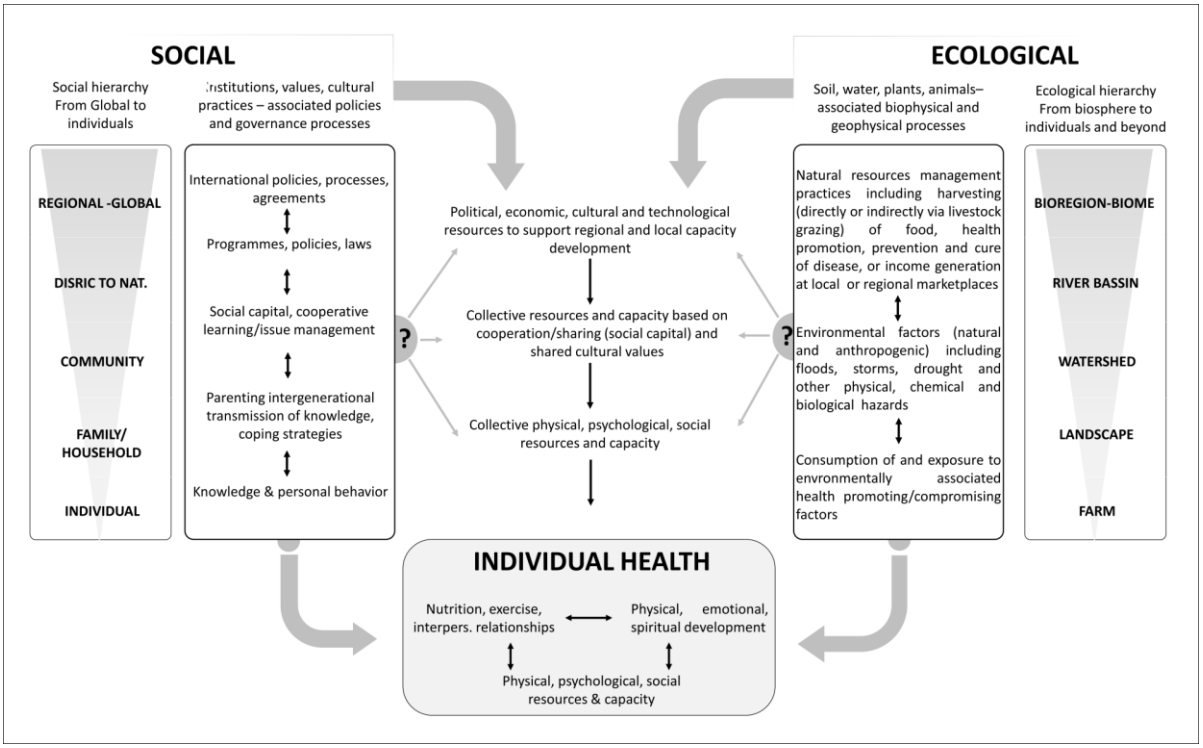


Figure 2. This diagram illustrates the interdependencies among social, ecological and health factors in rural, ecosystem-based societies intended to help guide interventions that could simultaneously address multiple SDGs directly and indirectly influencing health [18].

Moreover, rural people and communities throughout the developing world have been experiencing fundamental changes in their social, physical and biological environments largely associated with the shift away from small scale, diversified farming dependent upon traditional knowledge and farming methods, and indigenous crop and livestock genetic resources. This shift, which has tended to undermine social-ecological system resilience, is largely a result of government policies and programs. These generally have favored abandonment of these systems for larger scale, less diversified, commodity export crop production. The associated breakdown of social cohesion in local communities and the increased economic disparity is known to affect environmental, physiological and psychosocial health with mutually reinforcing influences [19].

Chronic as well as infectious disease risk increases under chronic and acute stress conditions due to both environmental and psychosocial exposures and circumstances associated with the rural transition

Environmental degradation, deforestation and agriculture intensification are significant downsides of recent decades of modernization in rural Southeast Asia [21]. Alarmingly, agrichemical overuse and exposure also have increased dramatically, for example, in rural Thailand in recent decades with 73%of the agrochemical imports into Thailand classified as extremely hazardous by WHO [21].

Increased cancer risk was estimated in fishermen throwing and/or placing a fish net in the water in central Thailand because of the presence of and exposure to dieldrin, DDT, β-HCH, heptachlor, and heptachlor epoxide in the canals. Similarly, drinking water or eating food contaminated with nitrates (from fertilizers) has a potential role in developing cancers of the digestive tract and has also been associated with other types of cancer. The relatively high incidence of cholangiocarcinoma in Northeast Thailand likely could be, accordingly, due more to the increasing amount of agrichemical use in agro-ecosystems than liver fluke infection [22].

Social-ecological system resilience and community health

Not only are rural populations' health dependent upon, and in fact interdependent with their environment, the same is true for urban dweller's. Their health similarly depends on their knowledge and skills which influence health behavior. The acquisition, maintenance, and transmission of healthy lifestyles depends upon unimpaired cognitive and emotional capacity. These qualities (or the lack of them) are reflected by problem-solving and decision-making capacity of families, the communities they constitute, and the larger social-ecological systems in which they are embedded.

Obviously, this capacity is needed as the basis for not only sound decisions affecting health but dealing effectively with uncertainty and managing risk collectively by a community. Awareness and perception of the environment (in fact the social resources as well), depends on individual and collective knowledge, awareness and skills. Termed social and cultural capital [23], these have been described as essential, along with ecological or natural capital, to how social-ecological systems retain, build, and lose resilience [24].

Finally, the importance of the maintenance and utilization of local knowledge, including traditional ecological knowledge [25] is a component of this conception of resilience. It has been shown to be essential for sustainable land use and environmental management practices as well as traditional medicine and healing practices. Integration with complementary modern biomedical technologies and treatment are increasingly widely accepted as essential to health systems that are truly effective and accessible. The current conventional health systems model, for example, described in reference to universal health coverage ignores how rural and even urban communities' function as social-ecological systems. Instead it is aligned more with a top-down, commercially oriented health services model, based predominantly on the Western allopathic medical-pharmaceutical paradigm that arguably not only is culturally insensitive but economically infeasible [26].

Emerging chronic and degenerative diseases

The dramatic increase in chronic, degenerative diseases, which collectively have been referred to as 'cardiometabolic diseases of civilization,' is rapidly surpassing EIDs as an even more challenging global health problem [27]. Though the ecological perspective is widely accepted as critical to understanding EIDs as well as risk behavior in relation to some chronic diseases, this is not case for this more recent emerging disease crisis.

However, the evidence shows this is, in fact, explained mainly by human's ecological transition in terms of lifestyle and especially diet and nutrition. As suggested by their description "as diseases of civilization," chronic degenerative diseases are typically found to be rare and often non-existent in non-industrialized cultures, with their longevity often similar to that of modernized societies [28].

Increased consumption of processed foods [29] and metabolism disrupting chemicals [30] may play important roles among other environmental exposures. More generally though, the increasing incidence of chronic and degenerative disease is believed by many researchers a consequence of the mismatch between our genetic heritage, which was molded by living with nature, and modern lifestyles.

Modern human populations' increasing separation from biologically diverse natural ecosystems and agroecosystems, and consumption of the plants and animal harvested from them rather than factory farms arguably are an important factor contributing to the current chronic and degenerative disease crisis [31]. This lends yet more support to the need to reframe health problems employing an ecological perspective.

Concluding thoughts

Health researchers and practitioners face the task of finding new ways to understand and more effectively address a wide range of emerging global health challenges. This will undoubtedly include disease and health related problems not yet even recognized, as was the case when modern health sciences emerged just over a century ago. The biomedical model and the theories of hygiene and sanitation that proved so successful then—and provided the foundation upon which today's predominantly Western allopathic oriented health systems are based—are giving way to new understandings.

Recognition of the need for new perspectives driven largely by the introduction of the ideas of positive health and health promotion [32] coincided with and undoubtedly were influenced by the development of ecological perspectives applied to disease and health. Parallel developments in biological ecology led to, among other things, the development of social-ecological systems theory. The framework and unique conception of resilience it provides offers a promising new way of thinking and set of tools for health research and practice. These are similarly applicable to a wide range of biological, social, and environmental challenges pertinent to sustainable development. Thus, the current focus on achievement the Sustainable Development Goals, nearly all of which have a health dimension when a health promotion-ecological perspective is considered, presents a unique opportunity for the health sciences.

To best exploit this opportunity, it may be helpful to consider that how a problem is framed determines the research questions asked, therefore the type of evidence generated and ultimately whether a health problem actually is meaningfully addressed and

ultimately solved [33]. Problem framing is integral to evidence-based research in public health, which has been defined as the "informed, explicit, and judicious use of evidence that has been derived from any of a variety of science and social science research and evaluation methods" [34]; and, is considered one of the defining characteristics of global health [35].

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Original Article Open Access

Factors Related to Serum Cholinesterase Level and Health Education of Insecticide Usage among Agriculturists in Wiang Kaen District, Chiang Rai Province, Thailand

Rocheeda Bintaleb[1], Jaturapornpun Prayonghom[1], Srisak Wonchaitha[2], Sitthikan Seemon[2], Peeradone Srichan[1], and Woottichai Nachaiwieng[1*]

[1]Public Health Program, School of Health Science, Mae Fah Luang University, Chiang Rai, THAILAND
[2]Por Health Promoting Hospital, Chiang Rai, THAILAND

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*Corresponding author: Woottichai Nachaiwieng, School of Health Science, Mae Fah Luang University, 333 M.1 Thasud, Muang, Chiang Rai, 57100, THAILAND

e-mail: woottichai.nac@mfu.ac.th

ABSTRACT

Introduction: Pesticides have been implicated in toxicity through routes including consumption of residues and inhalation. The previous reports show high amounts of agriculturists who obtained the toxic substance from pesticide throughout Thailand and Chiang Rai that leading to waste of public health funds. **Methods:** This study was surveying the 146 agriculturists by quota sampling for measuring serum cholinesterase level and assessing pre-test knowledge attitude and practice (KAP) in pesticide usage by using questionnaire as quantitative data. Only 62 people were completed the questionnaire in both pre- and post-test. The data were then analyzed the significant related factors associated with cholinesterase level by chi-square and descriptive statistical analysis. Related factors obtained were then used for preparing knowledge provided to agriculturists. Post-test of KAP and post serum cholinesterase level were later assessed. Qualitative data were also analyzed by dividing agriculturists into 2 groups of improved and non-improved of post-test KAP. The questionnaire for in-depth interview using open-ended question have been used to interview both groups for finding out the difference between two groups. **Result:** Three factors were found to be related with the enzyme cholinesterase level including family status, manure, and plant disease. KAP score of post-test questionnaire after providing knowledge to agriculturists were significantly higher at the p-values less than 0.05. In qualitative data, chemical storage, period of exposure time and eating behavior were found to be different between KAP improved and non-improved group. **Conclusion:** The knowledge program for agriculturists which prepared from related factor were efficiently improved KAP among them.

Keywords: Insecticide usage, Serum cholinesterase level, Health education program

Introduction

Pesticides have been implicated in toxicity through many routes including consumption of residues and inhalation [1,2]. Organophosphates and carbamates are widely used as insecticides in agricultural sector and patients who obtained toxic from this group of insecticides are the most common and important problems [3]. There were various researches reported that the pathophysiology of poisoning is quite complex making difficulty in treatment, so patients have a high mortality rate [4]. Worldwide, an estimated 3,000,000 people are exposed to organophosphate or carbamate agents each year, with up to 300,000 fatalities [5]. In Thailand, the reported cases of the toxic effects of substances during 2007 to 2013 were found predominantly in the central region of Thailand with about 15,262 to 22,035 cases each year (31 to 36% of the total cases), followed by the Northeastern region (27 to 31%), while the annual proportion of the North (18 to 20%) were almost equal to those of the South (18 to 19%) [6]. The incidence of toxic effects of substances chiefly non-medicinal as to source in Thailand between 2007 to 2013 were about 49,000 to 61,000 reported cases each year with morbidity rate between 76. 4 and 96. 6 per 100,000 populations these included all patients admitted in hospital received toxic substances [6]. From the Disease Control Department of northern Thailand reported that 13. 54 per 100,000 people in northern Thailand are hospitalized due to pesticide poisoning from farming [7]. Focusing on Ban Por Klang, Wiang

Kaen district, Chiang Rai, there are 95. 23% agriculturists who use pesticides especially insecticides in their farms and data from health promoting hospital show that almost of them were found to be high risk of insecticide exposure when monitoring their serum cholinesterase level.

Serum cholinesterase level have been widely used as biomarkers for the monitoring the exposure of organophosphates and carbamates pesticides [8]. Generally, there are two cholinesterase enzymes in human body: (1) acetylcholinesterase (AChE, EC 3.1.1.7) present in the nerve system, erythrocytes, brain and several tissues, and (2) butyrylcholinesterase (BChE, EC 3.1.1.8) found in serum or plasma which is synthesized by the liver. The organophosphates and carbamates pesticides produce toxicity to humans by inhibiting acetylcholinesterase activity on erythrocyte of human and butyrylcholinesterase in plasma [9].

Therefore, this study aims to explore factors related to serum cholinesterase level among agriculturists in Wiang Kaen district, Chiang Rai for preventing agriculturists from adverse reactions of insecticide and also reduce risks of pesticide exposure for saving Thai public health funds.

Methods

Various factors which may involve in serum cholinesterase level among agriculturists from questionnaire were specified as independent variables (Figure 1). Questionnaire was constructed by Dr. Denpong Wongwichit (personal contact) and Index of Item Objective Congruence (IOC) has already been performed.

Study design

This study was claimed to be mixed method study and the result was explained by both quantitative and qualitative data analyses. Firstly, the study focused on the examination of serum cholinesterase level and then exploration factors related to enzyme cholinesterase among agriculturists in Wiang Kaen district, Chiang Rai in quantitative method. Qualitative data were obtained by in-depth interviewed of risk serum cholinesterase level agriculturists. After obtained factors related to enzyme cholinesterase level, the health education about chemical usage in agriculturists were provided.

Population and sample

Agriculturists who use chemicals in agriculture including the head of family and able to attend in blood collection for 2 times (before and after the health education; the education that used related factors to cholinesterase level to make knowledge program). The exclusion criteria were missing on a second blood collection and unwilling to participate in this study.

Serum cholinesterase level determination

Serum cholinesterase level (cholinesterase reactive paper) was purchased from Government Pharmaceutical Organization (GPO). The interpretation was followed by kits instruction which categorized into 4 levels; unsafe, risk, safe and normal by colorimetric method. Unsafe, risk and safe are groups of people who exposed a different level of organophosphate and carbamate while, normal is the people who never exposed to pesticide at that time. Since the reactive paper was sensitive to various factors such as light, heat and humidity, but only this kit was available in the community. According to the instruction, sensitivity of this method is 77. 04%; specificity is 90. 01% and positive predicted value is 90.38%

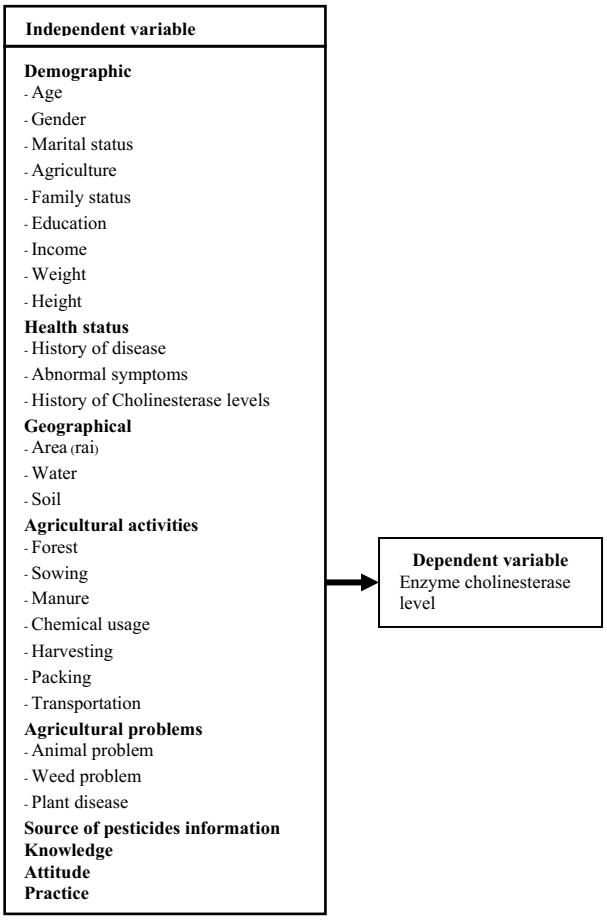

Figure 1 Conceptual framework of factors which may related to enzyme cholinesterase level among agriculturists in Wiang Kaen district, Chiang Rai

Data Collection

Pre- and post-questionnaires are the measurement tools for quantitative data collection. The assessment was assessed after 2 weeks after an intervention. During assessment the agriculturists were exposed to the chemical because of longan and pomelo planting period. The questionnaire consists of five parts

(demographic information, information of pesticide usage, knowledge, attitudes, and practice of chemical usage). To calculate knowledge, attitude and practices (KAP) score, a scoring system was prepared. Each correct answer was coded as 1, while each incorrect answer was coded as 0. In the practice section, components with better practice obtained a higher score up to 5, while respondents with poorer practice received lower scores. The final score for each category was then divided in quartiles. Four categories of knowledge, attitude and practice were outlined according to the score obtained by each respondent as low, medium, high, and very high [10]. The seven opened-end questionnaires by in-depth interview were used as qualitative data collection.

Intervention

Intervention was provided after the 1st survey among agriculturists in Wiang Kaen district, Chiang Rai. All factors were used to design the program of pesticide knowledge providing and program Prezi was used as knowledge providing media. Before providing an intervention, pre-questionnaire and baseline serum cholinesterase level were prior test.

Chart of Methodology

Total population of the community are 966 persons. Only 220 persons were our target group who use pesticide in agriculture, however, the people who unable to attend both pre- and post-serum cholinesterase enzyme level were excluded. The quota sampling was used as sampling technique and sampling for 146 persons. Sixty-two persons were completed the pre- and post-questionnaire and serum cholinesterase test. The quantitative data were obtained by interviewing using our questionnaire, while, qualitative data were obtained by using open end questionnaire of 7 persons of safe level of serum cholinesterase level (people who are normal and safe of serum cholinesterase level) and 7 persons of unsafe cholinesterase level (people who are unsafe and risk of serum cholinesterase level) as show in Figure 2.

Statistical analysis

Demographic characteristics, health status, geographical information, and agricultural role will be analyzed by descriptive statistical analysis and the factor associated with enzyme cholinesterase level were analyzed by inferential statistic using chi-square, logistic regression, and bivariate. The significance level at p-value less than 0.05 is used throughout the study.

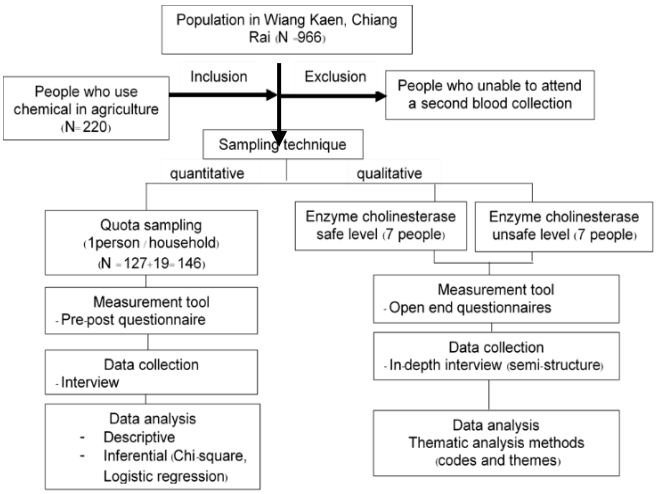

Figure 2 Methodology chart described workflow of this study

Results

The total participants were 62 persons who able to complete the pre- and post-test of questionnaire. Of these, 56.45% are male with age rank of 53-61 years old which calculated to be 53.23%. Most of them were graduated from the primary school 62.90% , low income 98.39%, had already married for 88.71%, heads of family are 56.45% , soil problem 62.90% , animal problem 95.16%, weed problem 62.90%, plant diseases 53.23%, and farming on their own 93.54% as described in Table 1. The result of serum cholinesterase level of agriculturists before intervention in Table 2 show 93.54% are not safe level and 6.45% are risky level, but the result after intervention show that 50% of people are risky level, 38.70% are not safe level and 11.29% are safe level so the results are better than before the intervention.

Table 2 show a percentage of Not safe subject before and after training. The Not safe subject was 93.54% in before intervention survey and decrease to be 38.70% after training. No one was found to have "Normal" level of cholinesterase.

Finding out the significant factors associated with serum cholinesterase level among agriculturists were family status who are head of family, using the manure during plantation, and having a problem about plant disease with p-value 0.001, 0.006 and 0.027, respectively (Table 3).

Table 1 General characteristics among agriculturists in Wiang Kaen district, Chiang Rai

Characteristics	n (%)	Characteristics	n (%)
Demographic		**Income (per year)**	
Gender		5,000-203,999 Baht	61(98.39)
Male	35(56.45)	>204,000 Baht	1(1.61)
Female	27(43.55)	**Expense (per year)**	
Age		4,000-183,199 Baht	61(98.39)
<43 years old	2(3.23)	>184,200 Baht	1(1.61)
44-52 years old	17(27.42)	**Period of farming (year)**	
53-61 years old	33(53.23)	1-14 year	4(6.45)
62-70 years old	8(12.90)	15-28 year	22(35.48)
>71 years old	2(3.23)	29-42 year	43(69.35)
Marital status		43-56 year	23(37.10)
Single	2(3.23)	57-70 year	3(4.84)
Married	55(88.71)	**Area (rai)**	
Widow	2(3.23)	1-13 Rai	30(48.39)
Divorce	2(3.23)	14-26 Rai	26(41.94)
Separate	1(1.61)	27-39 Rai	3(4.84)
Weight		40-52 Rai	2(3.23)
44-52 kg	12(19.35)	53-65 Rai	1(1.61)
53-61 kg	24(38.71)	**Water problem**	
62-70 kg	18(29.03)	Yes	34(54.84)
71-79 kg	6(9.68)	No	28(45.16)
80-85 kg	2(3.23)	**Soil problem**	
Height		Yes	39(62.90)
148-153 cm	14(22.58)	No	23(37.10)
154-159 cm	12(19.35)	**Cheap products problem**	
160-165 cm	23(37.10)	Yes	50(50)
166-171 cm	10(16.13)	No	12(19.35)
172-175 cm	3(4.84)	**Agricultural activities**	
Family member(s)		**Forest clearing before farming**	
1 person	1(1.61)	Yes	27(43.55)
2 persons	8(12.90)	No	35(56.45)
3 persons	18(29.03)	**Sowing**	
4 persons	18(29.03)	Yes	42(67.74)
5 persons	10(16.13)	No	20(32.26)
6 persons	3(4.84)	**Manure**	
7 persons	4(6.45)	Yes	49(79.03)
Family member(s) who are agriculturist		No	13(20.97)
1 person	13(20.97)	**Chemical usage**	
2 persons	43(69.35)	Yes	55(88.71)
3 persons	5(8.06)	No	7(11.29)
4 persons	1(1.61)	**Harvesting**	
Period of settle in the community		Yes	48(77.42)
<31 years	6(9.68)	No	14(22.58)
32-43 years	5(8.06)	**Packing**	
44-55 years	25(40.32)	Yes	13(20.97)
56-67 years	23(37.10)	No	49(79.03)
>68 years	3(4.84)	**Transportation**	
Family status		Yes	17(27.42)
Head of family	35(56.45)	No	45(72.58)
Spouse	21(33.87)	**Farm on their own land**	
Child	6(9.68)	Yes	58(93.54)
Education		No	4(6.45)
Illiterate	13(20.97)	**Hire**	
Primary school	39(62.90)	Yes	8(12.90)
Secondary school	5(8.06)	No	54(87.09)
High school	5(8.06)		

Interestingly, most of the agriculturists who use manure for their agriculture (93.54 %) were in risk group or people who were unsafe, risk, safe of serum cholinesterase level, while only 6. 45% were non-pesticide exposure group. When calculated the risk of manure by univariate regression, it was found that agriculturists who use manure for their agriculture has greater risk than agriculturists who do not use for 14.4 times (Table 4).

Table 1 General characteristics among agriculturists in Wiang Kaen district, Chiang Rai (n=62) (Continued)

Characteristics	n (%)	Characteristics	n (%)
Agricultural problems		**Recover by themselves after illness**	
Animal problem		Yes	23(37.10)
Yes	59(95.16)	No	39(62.90)
No	3(4.84)	**Go to district hospital after illness**	
Weed problem		Yes	7(11.29)
Yes	39(62.90)	No	55(88.71)
No	23(37.09)	**Go to health promoting hospital after illness**	
Plant diseases		Yes	31(50)
Yes	33(53.23)	No	31(50)
No	29(46.77)	**History of cholinesterase level**	
Health status		Never determined	29(46.77)
Rash		Determined, normal	15(24.19)
Yes	7(11.29)	Determined, safe	6(9.677)
No	55(88.71)	Determined, risk	7(11.29)
Tired		Determined, unsafe	3(4.83)
Yes	18(29.03)	**Source of pesticides information**	
No	44(70.97)	**Radio**	
Numb		Yes	14(22.98)
Yes	9(14.52)	No	48(77.42)
No	53(85.48)	**TV**	
Headache		Yes	40(64.52)
Yes	19(30.65)	No	22(35.48)
No	43(69.35)	**Newspaper**	
Sweating		Yes	8(12.90)
Yes	17(27.42)	No	54(87.09)
No	45(72.58)	**Village headman**	
Nausea		Yes	7(11.29)
Yes	2(3.22)	No	55(88.71)
No	60(96.77)	**Village Health Volunteer**	
Amblyopia		Yes	13(20.97)
Yes	6(9.68)	No	49(79.03)
No	56(90.32)	**Public Health Officer**	
Tremble		Yes	24(38.71)
Yes	1(1.61)	No	38(61.29)
No	61(98.39)	**Knowledge before intervention**	
Angina		Medium level	18(29.03)
Yes	1(1.61)	High level	44(70.97)
No	61(98.39)	**Attitude before intervention**	
Faint		Low level	12(19.35)
Yes	7(11.29)	Medium level	21(33.87)
No	55(88.71)	High level	23(37.10)
Unconscious		Very high level	6(9.68)
Yes	1(1.61)	**Practice before intervention**	
No	61(98.39)	Medium level	3(4.83)
		High level	59(95.16)

The in-depth interviewing found that there were different factors between people who improve serum cholinesterase result (their serum cholinesterase level result was safer) and unimproved group (their serum cholinesterase level result was not change or unsafe) that associated with enzyme cholinesterase level. These factors were chemical storage before and after use, eating behavior and time to exposure the chemicals (Table 5) . As observed during in-depth interview, the people who had an improvement of serum cholinesterase level, were kept their pesticide outside their home after obtained an intervention. Moreover, they tend to consume their own vegetable which grown around their home and clean them with flowing water.

Moreover, after intervention of health education providing, knowledge, attitude and practice of chemical usage among agriculturists were all improved to the higher category (Table 6). Knowledge of 62 agriculturists in Wiang Kaen district, Chiang Rai were all improved to high level, while, attitude and practice of 30 agriculturists were improved to be very high without low level of attitude and practice remaining.

Discussion

There are 3 factors found to be related in unsafe serum cholinesterase level among agriculturists in Wiang Kaen district, Chiang Rai in this study

Table 2 The serum cholinesterase level of agriculturists before and after intervention (n=62)

Result	Before intervention		After intervention	
	n	Percentage (%)	n	Percentage (%)
Normal	0	0.00	0	0.00
Safe	0	0.00	7	11.29
Risky	4	6.45	31	50.00
Not safe	58	93.54	24	38.70
Total	62	100.00	62	100.00

Table 3 Factors associated with cholinesterase level among agriculturists in Wiang Kaen district, Chiang Rai (n=62)

Variables	Normal n(%)	Risk n(%)	χ^2	p-value
Family status				
Head of family	1(2.86)	34(97.14)	15.92	0.001*
Spouse	2(9.52)	19(90.48)		
Child	1(16.67)	5(83.33)		
Manure usage				
Yes	1(1.61)	48(77.41)	7.53	0.006*
No	3(4.84)	10(16.13)		
Plant disease				
Yes	0(0.00)	33(53.22)	4.87	0.027*
No	4(6.45)	25(40.32)		

*Significant at p-value < 0.05

Table 4 Factors associated with cholinesterase level by univariate regression (n=62)

Factors	Normal	Risk group	OR (95% CI)	p-value
Manure	4(6.45)	58(93.54)	14.4(1.3- 13.0)	0.027*

*Significant at p-value < 0.05

Table 5 Result of qualitative study about chemical usage between improved and unimproved group of serum cholinesterase level

Difference	Improved group	Non-improved group
Chemical storage before and after use	Separate chemicals storage outside the home	Kept the chemicals in the house or in the kitchen
Eating behavior	Did not bought the vegetables from the market	Bought the vegetables from the market
Time to exposure the pesticides	Last time more than 2 days	Last time less than 2 days

including family status who are head of family, using the manure during plantation, and having a problem about plant disease. As Thai tradition, the head of family should be the leader of farm works and be the most risk person to contact to pesticides. During plantation, manure was widely used to improve agricultural productivity. As manure is one of significant factor and seem to be nonsense to describe the relation between this factor and unsafe serum cholinesterase, but data obtaining from agriculturist might be miscommunicated and confused about pesticide usage or manure usage. Another hypothesis is during manure usage, agriculturists might be directly contact to pesticide which has recently been applied to plants. Moreover, the agriculturists who had plant disease must use higher dose of pesticides and have a higher risk than those who have no plant disease problems.

Comparing with previous researches, the review about occupational pesticide exposures and respiratory health, found in occupational settings, persons working directly and frequently with pesticides are groups with the highest risk of exposure [1]. Multiple logistic regression analysis revealed 7 factors were independently associated with abnormal serum cholinesterase level: male gender, marital status, being a permanent worker, spraying pesticide more than 3 times per month, having moderate or poor pesticide-use behaviors, and low perceived susceptibility and severity of pesticide use [11]. Furthermore, the frequency and duration of pesticide handling both on a seasonal and lifetime basis are directly affects the exposure [12]. Especially agriculturists who regard to

marital status of the subjects, 98 cases were married and 92 were unmarried [13]. Gender also affects on the serum cholinesterase level (p-value=0.002), indicating that people with pesticides in the blood were at a risk level and the level of insecurity is mostly in males (52%) [14].

Table 6 The score of KAP in chemical usage before and after intervention among agriculturists in Wiang Kaen district, Chiang Rai

Score (n=62)	Pre-test (n)	Post-test (n)
Knowledge		
Low	0(0.00)	0(0.00)
Medium	18(29.03)	0(0.00)
High	44(70.96)	62(100.00)
Attitude		
Low	12(19.36)	0(0.00)
Medium	21(33.87)	7(11.29)
High	23(37.10)	25(40.32)
Very high	6(9.68)	30(48.40)
Practice		
Low	12(19.36)	0(0.00)
Medium	21(33.87)	7(11.29)
High	23(37.10)	25(40.32)
Very high	6(9.68)	30(48.40)

The study of effectiveness of an educational program to promote pesticide safety among pesticide handlers of South India found that the average baseline KAP score of 30.88±10.33 improved after education significantly (p-value<0.001) [15]. These indicating that they might be other risk factors related to cholinesterase level and vary depending on each area. In addition, previous study found a strongly significant association between level of knowledge and serum cholinesterase level (p-value<0.001) [16]. This means knowledge providing activity is important to improve serum cholinesterase level and also KAP score among small group of agriculturists [17].

Conclusion

There were 3 factors associated with unsafe serum cholinesterase level among agriculturists in Wiang Kaen district, Chiang Rai and used to prepare an intervention. The health education providing intervention program for agriculturists which prepared from related factors were efficiently improved KAP among them. In addition, the qualitative data found the different behavior between groups of improved and non-improved serum cholinesterase level by observing and in-depth interviewing. However, due to a limitation of time, only 2 weeks of assessment have been carried out. For more sustainable, repeating of an intervention to the community and assess the effect of intervention by measuring KAP score and serum cholinesterase enzyme level in longer period should be performed.

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Pharmacognostic Specifications of *Acanthopanax trifoliatus* leaves

Aunyachulee Ganogpichayagrai[1]*, Pitchaya Songthong[1], Phakjira Chaiyawong[1], Panida Jeawkok[1], Phitchayut Mungmuang[1], Sunisa Malao[1], Chutinan Suksaard[2], Thidarat Duangyod[1] and Rawiwan Charoensup[1]

[1]*School of Integrative Medicine, Mae Fah Luang University, Chiang Rai 57100, THAILAND*
[2]*School of Health Science, Mae Fah Luang University, Chiang Rai 57100, THAILAND*

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*Corresponding author: Aunyachulee Ganogpichayagrai, School of Integrative Medicine, Mae Fah Luang University, 333 M.1 Thasud, Muang, Chiang Rai, 57100,THAILAND

e-mail: aunyachulee.gan@mfu.ac.th

ABSTRACT

Introduction: *Acanthopanax trifoliatus* or Phak-pam has been popularly used as both medicinal plant and food plant in Northern of Thailand. **Objective:** The present study aims to investigate the pharmacognostic specifications to authenticate *A. trifoliatus* leaves. **Methods:** Leaves of *A. trifoliatus* from 12 sources throughout Thailand were collected, then morphological and physiochemical determinations following WHO guideline of quality control methods for medicinal plant materials were used to investigate leaves samples. **Results:** Morphological identification revealed remarkable microscopic characters were rosette crystals of calcium oxalate and anisocytic stomata. Physico-chemical parameters including; loss on drying, total ash, total acid insoluble ash, water content, ethanol soluble extractive and water soluble extractive values were found to be 1.08±0.17, 10.52±1.33, 1.67±0.30, 9.87±1.32, 6.76±4.41 and 6.67±0.57, respectively. *A. trifoliatus* leaves contained traces of volatile oil. **Conclusion:** This study provided useful information of pharmacognostic specification that could be used for authentication, identification and quality control of *A. trifoliatus* leaves.

Keywords: *Acanthopanax trifoliatus*, Phak-pam, Pharmacognostic specification, Physicochemical specification

Introduction

Acanthopanax trifoliatus, also known as Phak-pam, belongs to the Araliaceae family [1]. Its leaves have been used as both medicinal plant and food plant in local Thai cuisine. As a medicinal plant, decoction of *A. trifoliatus* leaves was used to treat tuberculosis and lung hemorrhage and as a tonic to improve general weakness [2]. *A. trifoliatus* leaves extracts had anti-inflammatory effects in acute and chronic inflammation [3], as well as showed positive results on cognitive and emotional deficits within olfactory bulbectomized mice [4]. Its essential oil from leaves also had antimicrobial effect [5]. However, there was no report for *A. trifoliatus* leaves authentication. In this study aims to investigate the pharmacognostic specifications to authenticate *A. trifoliatus* leaves following the World Health Organization guideline of quality control method [6]; including macro- and microscopic, loss on drying, total ash, acid- insoluble ash, water content, volatile oil content, ethanol and water-soluble extractive values and TLC fingerprinting profiles.

Methods

Plant material

A. trifoliatus leaves samples were collected from 12 different geographical sources in Thailand. The samples were authenticated and compared to herbarium at Queen Sirikit National convention, Chiang Mai, Thailand. Voucher specimens were deposited at Department of Applied Thai Traditional Medicine, School of Integrative Medicine, Mae Fah Luang University, Chiang Rai, Thailand. After removal of any foreign matters, all samples were dried in Solar Green House and grinded by using mechanical grinder into powders.

Pharmacognostic specifications

Morphological identification

Macroscopic identifications including size, shape and other visible characteristics were observed with naked eye or using a magnifying glass. Microscopic identifications were observed both transverse section and ground powders under a microscope to identify tissue and cell structures.

Physio-chemical determination

All pharmacognostic parameters were determined using quality control method for medicinal plant materials following WHO guideline [6]. Weighed 3 g of dried samples in crucibles, then dried at 105 °C until constant weight was obtain to determine loss on drying. After that, 3 g of dried samples was burnt at 500 °C for 6 h, placed crucibles in a desiccator for 30 min, then observed and weighted the carbonless ash to obtain total ash. Added 2 N of HCl, 25 ml into the remaining ash, gently boiled in water bath for 5 min and burnt it at 500° C for 6 h, then filtrated with ash less filter paper (No. 40) and then placed the crucibles in a desiccator for 30 min to obtain acid insoluble ash. Water content was determined using Azeotropic method, weighed 25 g of dried samples, then added 200 ml of water-saturated toluene; after the water completely separated from water-saturated toluene, measured and calculated the water volume. The volatile oil content was measured by using Clevenger distillation method, weighed 50 g of dried samples then added 200 ml of water; after volatile oil completely separated from water, measured and calculated volatile oil volume. Determination of extractive value, weighed 5 g of dried samples, then macerated with 70 ml of solvents (water or 95% ethanol); shacked with orbital shaker for 6 h, left on standing for 18 h then filtrated with filter paper rapidly. Pipetted adjusted volume to 100 ml, then dried it on a hot water bath at 105 °C until the constant weight was appeared. All samples were done in triplicate. The results were reported by grand mean ± pooled standard deviation. For TLC fingerprinting, the ethanol extract was determined using Silica gel 60 F_{254} plate as stationary phase and a mixture of acetone: hexane (3:7) as mobile phase. It was developed in TLC chamber saturated with a solvent system. After the development of mobile phase, the plate was removed and allowed it to dry, then observed spot on the plate under ultraviolet light (254 and 365 nm) and daylight.

Results

Figure 1, 2, and 3 demonstrated morphological identification of *A. trifoliatus* leaves.

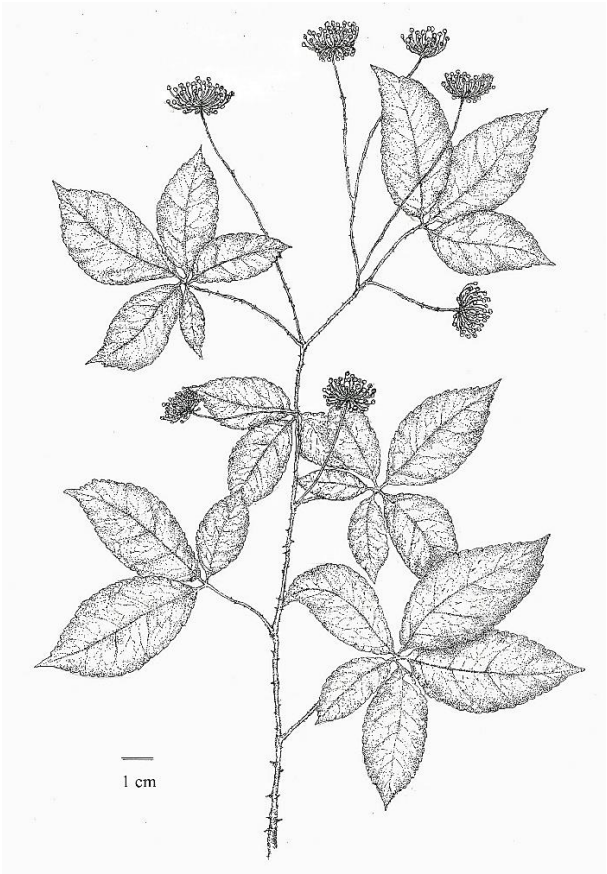

Figure 1 Macroscopic characteristic; whole plant of *A. trifoliatus*

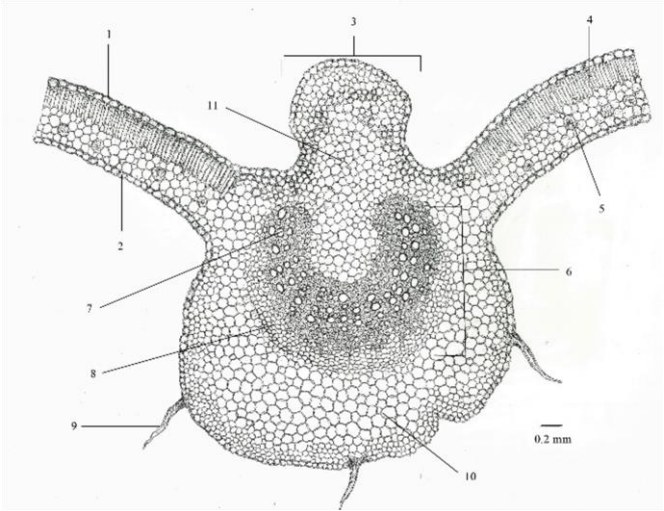

Figure 2 Microscopic identifications; anatomical characteristics (transverse section) of *A. trifoliatus* leaves;

1. upper epidermis;
2. lower epidermis;
3. midrib;
4. palisade parenchyma;
5. spongy parenchyma;
6. vascular bundle;
7. xylem vessels;
8. phloem;
9. covering trichrome;
10. parenchymatous cells;
11. collenchyma

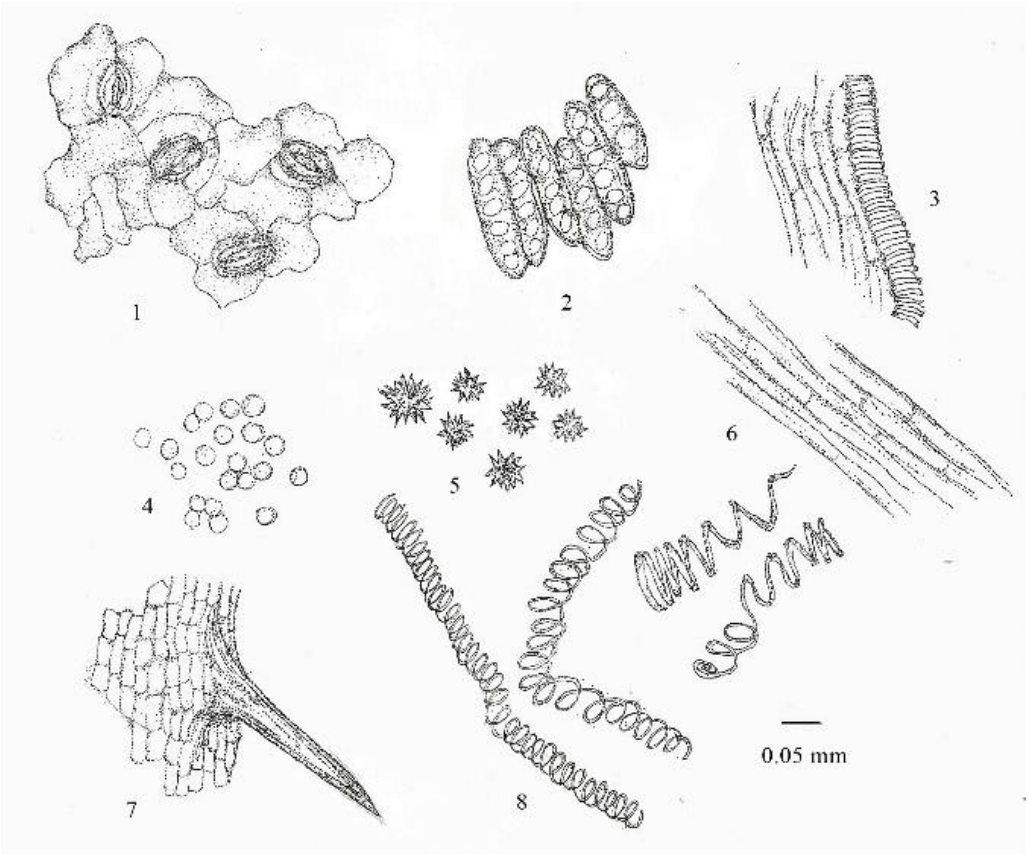

Figure 3 Microscopic identifications; histological characteristics of *A. trifoliatus* leaves powders; 1. anisocytic stomata; 2. fragment of xylem vessels; 3. part of fiber with reticulated vessel; 4. chlorophyll cells; 5. crystals of calcium oxalate (rosettes); 6. fragment of fiber; 7. covering trichrome; and 8. spiral vessels

Discussion

Macroscopic and microscopic examinations are the first step to identify and purify the plant materials [6]. The macro- and microscopic examinations of *A. trifoliatus* were shown in figure 1-3. Leaves are green color. Leaf shape is palmately compound with 3-5 leaflets, 2-5 cm wide and 4-10 cm long, papery surfaces with slightly setose, base cuneate, margin serrulate, apex acute or acuminate. Anatomical characteristics of *A. trifoliatus* leaf were shown in figure 2. Specific histological characteristics were rosette shaped of calcium oxalate crystals and anisocytic stomata as shown in figure 3. They could be used as an instrument for the identification in crude drugs. Rosette crystals of calcium oxalate located in the lower epidermis region. Anisocytic stomata located in the leaf surface, usually bounded by three or four subsidiary cells, one of which was noticeably smaller than the others. [7,8].

Pharmacognostic parameters of *A. trifoliatus* leaves were shown in figure 4 and table 1. The water in plant materials can increase microbial growth. The azeotropic method for water content gives a direct quantity of the water present in plant materials. Loss on drying determines both amount of water and volatile [6]. Water content *A. trifoliatus* leaves should not more than 11.42% (w/w). Loss on drying should not more than 1.28 % (w/w). *A. trifoliatus* leaves contained traces of volatile oils. Ash content investigates reveals the degree of foreign inorganic matter for controlling quality of crude drug; the total ash includes amount of both physiological ash, and non-physiological ash (e.g. sand and soil) stick to plant surfaces. Acid-insoluble ash includes amount of silica present [6]. Total ash of *A. trifoliatus* leaves should not more than 13.43% (w/w); acid insoluble ash should not more than 2.36% (w/w). Extractive values revealed both quality and purity of crude drugs [9]. Ethanol soluble extractive of *A. trifoliatus* leaves should not less than 2.01% (w/w); water soluble extractive should not less than 5.69 % (w/w). Thin layer chromatography fingerprinting was presented in figure 4. The Rf value was showed on chromatogram. It could be used as marker characteristics fingerprint profiles of *A. trifoliatus* leaves.

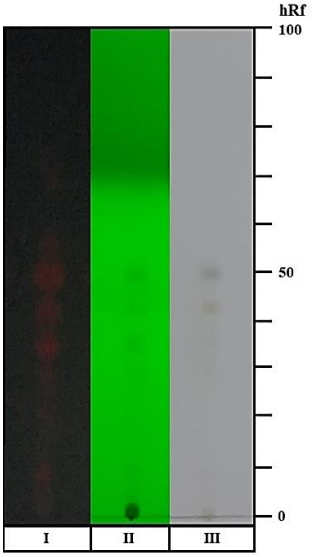

Figure 4 Pharmacognostic specifications *A. trifoliatus* leaves: I, detection under UV light 365 nm; II, detection under UV light 254 nm; and III, detection under daylight

Table 1 Quality parameters

Quality parameters	Grand mean ± pooled SD*	Min-Max*
Loss on drying	1.08 ± 0.17	0.79 - 1.28
Total ash	10.52 ± 1.33	8.57 - 13.43
Acid insoluble ash	1.67 ± 0.30	1.28 - 2.36
Water content	9.87 ± 1.32	7.70 - 11.42
Ethanol soluble extractive	6.76 ± 4.41	2.01 - 15.72
Water soluble extractive	6.67 ± 0.57	5.69 - 7.61
Volatile oil	Trace	Trace

*All samples were done in triplicate

Conclusion

The pharmacognostic specification of *A. trifoliatus* leaves in Thailand was established. This study provides useful information not only for authentication but also quality control and identification both its leaves and specimens.

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Hypertension among Health Workers in Nepal: The Health of Health Guardians, 2005-2019

Prakash Ghimire[1,2*] and Alisha Khadka[3]

[1]*School of Health Science, Mae Fah Luang University, Chiang Rai, THAILAND*
[2]*Department of Health Services, Ministry of Health and Population, NEPAL*
[3]*College of Nursing, Nepalese Army Institute of Health Sciences, NEPAL*

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*Corresponding author:
Prakash Ghimire, Buddhanagar-10, Kathmandu, NEPAL

e-mail:
prakash.ghimire707@gmail.com

ABSTRACT

Background: Hypertension as the iceberg disease is the major public health concern of this era where global population, especially in low and middle-income countries, are facing its escalating burden. The working-age group population is the principal victim of the morbid and deceased state due to hypertension. The vital workforce of the nation, the health workers are not spared from the thunder of hypertension means several studies around the world piled up the evidence of their vulnerability for hypertension. **Objective:** The aim of this study was to do a systematic review of literature related to hypertension among health workers in Nepal. **Methods:** The systematic review of articles and information related to hypertension among health workers in different countries including Nepal published from 2005-2019 using PubMed, PMC, Google scholar and Google was done. The data on prevalence of hypertension, risk factors of hypertension, impact of hypertension, health system and policy in relation to hypertension among general people and health workers were extracted from databases for the systematic review. **Results:** As other nation's health workers, health workers of Nepal are shading under the environment which encloses the liable risk factors of hypertension. With the reason of lacking health information of health workers in Nepal, the health system of Nepal is still in the mirage that the health of their health workers does not deviate and not of priority concern. In addition, health workers of Nepal are overlooking their health by practicing unhealthy behaviors knowingly or unknowingly leading to the genesis of hypertension. **Conclusion:** In conclusion, the health workers of Nepal are in the potential risk of hypertension as similar to another workforce as well as the general population. Therefore, this hidden truth needs to be investigated, uncovered and addressed accordingly by the health system of Nepal and health workers themselves.

Keywords: Hypertension, Health Workers, Nepal

Introduction

Hypertension, also known as the silent killer, is an emergent public health issue accountable for massive global morbidity and mortality [1,2] . The concealed burden of hypertension is escalating and devouring the world as a submerged portion of the iceberg. Non communicable disease (NCD) is one of the significant burning issues of this era especially in the low and middle-income countries [1]. The four major NCDs i.e. cardiovascular diseases (CVDs), cancer, chronic respiratory disease, and diabetes are responsible for 82.0% of total NCD deaths in which cardiovascular disease embrace in an uppermost rank (17. 9 million deaths; 44.0% of all NCD deaths and 31.0% of global deaths) [1, 2]. More than half (9.4 million) of deaths among total CVD deaths are due to complications of hypertension which is higher than all deceases from communicable diseases combined [3].

The problem of hypertension is growing at an alarming rate mainly in the working-age population. Around 12. 2 million people of active working age, mostly in the least developed countries die each year due to non-communicable diseases comprising hypertension [4] . Workers are fall in the age group of the adult population who were suffering from 75. 0% of high premature deaths from NCDs including hypertension worldwide [4,5]. Health workers are the essential cohort or workforce of the nation whose services are precious

for fostering the better health of the population and being on the front line of direct contact with the patient, their family, and communities [6]. This population is thought and supposed to be healthy in almost all circumstances in the communities. However, several occupational risk factors along with the common risk factors were identified in their life and work settings which put them susceptible to the acquisition of hypertension [7].

Nepal is a brick-shaped low-income country located in the South-East Asia Region currently in the state of epidemiological transition. With the striving to control the communicable diseases, the health of Nepalese people is devastating by the burgeoning burden of NCDs; mainly hypertension [8]. Unevenly distributed health workers of Nepal has the core responsibility to control and prevent hypertension among the general population [9]. Nonetheless, these health guardians of Nepal can also be in the probable risk of hypertension because of their working status in the unsound environment with limited resources [9-12]. To understand this situation, this study aims to systematic review of literature concerning hypertension among health workers in Nepal.

Methods

The systematic review study design was applied to review the literature related to hypertension among health workers of Nepal in this study. No other population was involved to design or conduct this review. The inclusion criteria in this systematic review were articles, reports, web information with citation published in 2005-2019 which was extracted from databases (PubMed, PMC, and Google scholar) and Search engine (Google). All the articles about hypertension among children, elder population, and workforce other than health workers were excluded during the process of literature review. The keywords used to search the records in the databases and search engine were prevalence, risk factors, health policy and program-related hypertension, impact, health workers, Nepal. A protocol was followed in the information identification for systematic review as mentioned in figure 1.

Then the information was reviewed systematically after its categorization into different sections; hypertension in the general population, hypertension in health worker, risk factors of hypertension among health workers, impact of hypertension among health workers, and health system, health policy, and health workers of Nepal in relation to hypertension.

Results

Out of total articles and information searched from the different database and search engine, we have selected 56 articles, reports, and web page information which was reviewed consequently after categorization as follows:

Hypertension in the general population

The global prevalence of hypertension in the adult population (aged ≥ 18 years) was around 22.0% [13]. It was found that the number of the hypertensive adult population was increased from 594 million in 1975 to 1.13 billion in 2015 with the main upsurge in low income and middle-income countries [14]. In addition, it has been projected that by 2025, about 75.0% of the world's hypertensive population will be in developing countries [15]. The burden of hypertension in the South East Asia Region (SEAR) was worse where hypertension accounts for 1.5 million deaths each year and found that one in three adults has high blood pressure. Furthermore, the prevalence of hypertension in the adult population aged >25 years in the countries of SEAR ranged from 19.0% to 42.0% [16,17]. The prevalence of hypertension in Nepal was found to be highest (33.8%) as equated to other SAARC Countries [18].

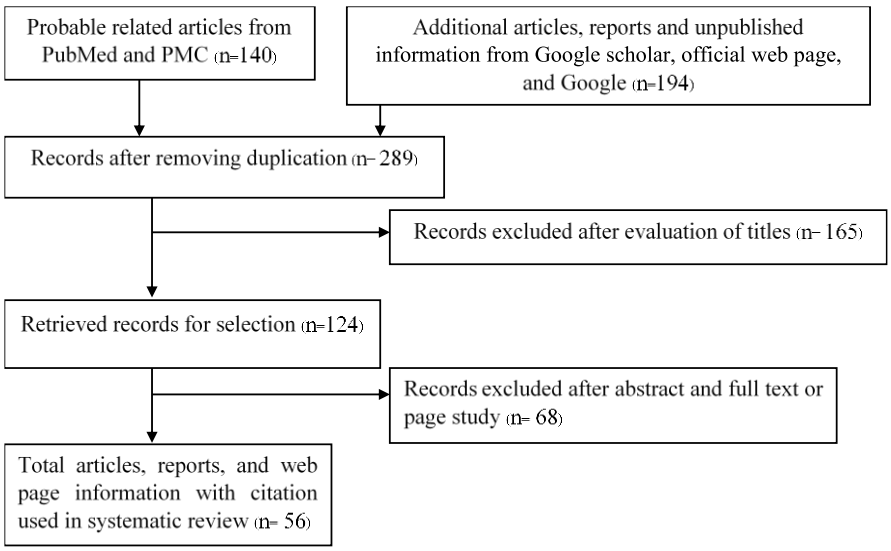

Figure 1 Protocol followed during information identification for review

Latest national step survey reveals that 1/4th (25.7%) of the Nepalese adult were suffering from hypertension where tobacco use, alcohol consumption, physical inactivity, low fruit, and vegetable consumption as risk factors of hypertension were substantially high [19]. The evidence of mushrooming of hypertension was surplus by the repeat cross-sectional study which reveals the three-fold increment of hypertension rate among the same population of Kathmandu district in between the period of 25 years [20]. The pooled analysis of the prevalence of hypertension in different geographical areas of Nepal was ranged from 15.1% to 38.9% [21-24].

Hypertension in health workers

Several studies have been conducted in various parts of the world presented the general inclination of CVD risk factors including hypertension among health workers than other occupational groups [25]. The global health worker scarcity is expected to worsen, due to the aging and prevalence of chronic diseases such as hypertension within this group higher with the general population in some studies [6,25-29]. There were limited studies happened before related to hypertension among health workers, nonetheless previous studies done among varieties of health workers in South Africa (nurses), India (doctors and nurses), Indonesia (hospital workers), Taiwan (physicians), Nigeria (health care workers), and Brazil (health care workers), shows the prevalence of hypertension as 52.0% [29], 21.6% [30], 14.2% [31], 21.7% [28], 41.9% [32], and 33.0% [33] respectively. However, there is no report has been published yet on the prevalence of hypertension among health workers in Nepal.

Impact of hypertension among health workers

Hypertension among health workers does not impact only as of the loss of their life, but also accountable for their deprived quality of life, altered mental health, disability, the indirect burden to the national financial expenditure and altered health service delivery system or reduced productivity due to absenteeism in their workplace [3,13,34-36]. Almost US $ 500 billion annual lost economic output in low and middle-income countries are due to cardiovascular disease including hypertension [3]. The impact of hypertension on the mental health of the hypertensive population are substantial; they experience anxiety, depression, and stress due to known hypertension [36]. Hypertension is the top one risk factor contributing to about 211.8 million of the global disability-adjusted life years (DALYs) in 2015 [37]. Based on the Centers for Disease Control and Prevention's (CDC's) workplace safety data, hospital workers have an 18.0% greater chance of dying from the hypertensive disease as someone in the general population [38,39]. In addition, a white paper shows the high chronic illness rate; hypertension is one of the top 10, high health care cost, and high service utilization rate among hospital workers than general workforce [34]. Health workers in patient health education regarding lifestyle modifications have a vital role in the control of hypertension [40]. The efficiency of patient education may be improved by attending health workers having healthy behaviors. Studies uncovered that the health workers who have adopted healthy behaviors (physical activity, no tobacco use, weight management, drank less alcohol) helps to make them a role model and probability of high success rates in patient management [40-43]. Therefore, the health status of general people can be directly or indirectly determined by the lifestyle, health behaviors and health status of health workers. So it is important to maintain the health of health workers for the sake of health workers themselves as well as for the general people.

Risk factors of hypertension among health workers

Health workers have a dual responsibility to control and prevent hypertension among people and themselves. Besides their role as a guardian of the health of the people, unfortunately, this group is exposing with varieties of stressors in their workplace such as work overload, deprived sleep, repeated exposure to emotionally changed states, dealing with difficult patients, and conflicts among staffs, psychological stress, long hours of work, shift duties, and unhealthy that may act as an inducer for hypertension [4,30,34,44-46]. Few studies around the world have been identified the significant associated factors of hypertension in health workers such as increasing age, gender, smoking, physical activity level, marital status, unhealthy diet, educational level, increased body mass index (BMI), history of diabetes, stress, less sleep duration, shift work, long work duration, and employment status [25,31,44,46-50]. However, the problem among this population still remained unchanged in most of the developing countries. Despite the high health related knowledge among health workers and their proximity to the health care service delivery point, they are often practicing unhealthy behaviors and overlooked in health screening activities which puts them to the high-risk group for hypertension as compared to other workforce [7,29].

Health system, health policy, and health workers of Nepal in relation to hypertension.

The paradigm of the health system in Nepal is changing with the time period where health workers always act as a significant pillar of Nepal's health system. As Nepal progress towards three-level federalized health system i.e. federal, provincial, and local, the deployment of health workers in three levels are considered to be the great challenge where their responsibility to outline structure and give life to the health care system under federalism is crucial [51,52]. Until now, the health workers are disproportionately distributed and working in the three different tiers of the health system of Nepal i.e. primary level, secondary

level, and tertiary level [53]. The health system of Nepal is guided by an umbrella national health policy 2014 followed by other specific health related policy and programs [54]. Among them, Nepal Package of Essential Non-Communicable Diseases (PEN) program is the only one specific program; one of the action areas of the multisectoral action plan for the prevention and control of NCD (2014 to 2020) that works in the field of hypertension control among Nepalese population. The Nepal PEN program that provides training to the health workers in order to control the non-communicable disease among the general population is limited only to primary health care level of selected districts in Nepal [55,56]. Many of the health workers in other districts and other tiers of the health system are unaware of this national PEN protocol that deprives them of the opportunity to get NCD specific training [55, 56]. In addition, health workers working especially in secondary and tertiary level hospitals are supposed to have a high burden of workload, less leisure time, inadequate sleep duration, and shift work [10,11] that can be additional significant drivers for factors associated with hypertension and hypertension itself.

Discussion

It is the first review on hypertension among health workers in Nepal. This study reviews the numerous articles along with web information to encounter the objective of the study. Even of high health related knowledge and closeness to the health organization, the review reveals the high prevalence of hypertension among health workers ranged from 14.2% to 52.0% in different geographical areas in the world such as Nigeria, South Africa, India, Taiwan, Indonesia, and Brazil [28-33]. Similarly, the trembling information about risk factors and the impact of hypertension in health workers were dug out though this review [25,44,46-50]. During the information identification and process of review, we found that no article has been published yet which directly demonstrates the figures related to hypertension among health workers in Nepal. However, some studies from other countries and Nepal added up evidence as the health workers of Nepal are equally susceptible for hypertension because of inadequate health policy alongside altered lifestyle in unhealthy work setting [10,11,55,56].

Much of the information shown in the results section helps to presume that the health workers of Nepal are also one of the key vulnerable groups for hypertension. However, Nepal lacks the health information of their health workers. Till date, there is no routine health screening and reporting program related to hypertension for the health workers. The health of health workers is often neglected by health workers themselves and the health system as well where it is pretended that their health cannot deviate because they are thought to be keen to maintain their health. If the health of health workers is found deviated, they are known to be incapable to treat their patients.

Thorough review thrust to the concept that health workers are equally susceptible to the genesis of hypertension as compared to the general population as well as another workforce. It is time to think about the health of our health guardian. In Nepal, health workers are treated as a god where they spend their life to maintain the health of the people. Even of their miracle works to uplift the health of the people, sometimes we should need to contemplate that they are also liable to their health deviation because of the several stressors in their workplace and life. The health workers themselves and the health system of the nation should be fretful to prevent and control hypertension among health workers with the account that their role to upgrade and sustain positive health of the people is remarkably concerned. The routine health screening program along with further research is needed to explore the veiled truth; hypertension among health workers of Nepal.

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Depression among Orphans: Situation and Trend in Nepal

Kumari Bandana Bhatt[1,2*], Navin Bhatt[3]

[1]*School of Health Science, Mae Fah Luang University, Chiang Rai, THAILAND*
[2]*Epidemiology and Disease Control Division, DoHS, MoHP, NEPAL*
[3]*Bayalpata Hospital (Nyaya Health Nepal/Possible), Achham, NEPAL*

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*Corresponding author: Kumari Bandana Bhatt, Bhimdutt-10, Kanchanpur, NEPAL

e-mail: b.bandana12@gmail.com

ABSTRACT

Background: Orphans are a special group of children who are more vulnerable to developing a mental health problem such as depression. Lack of care and support during the grieving process and inadequate environment without parents may lead to depression in orphans. Depression is an important public health problem and a serious issue that affects almost half of the orphans. **Objective:** The study aimed to explore the status of depression among the orphans in Nepal. **Methods:** The literature review was done based on the information obtained from the grey literature and the published articles in national and international journals through web search in Pubmed and Google scholar. **Results:** The review identified orphans as a susceptible group of children who are prone to developing mental health problems. In Nepal, more than one million children are orphans and the prevalence of children with one or both parents dead is 4.3%. Depression is one of the commonest mental health problems among the orphans accounting for almost half of the orphans and almost double than the population of general children. Though the government of Nepal established childcare homes to provide care, support, protection and other needs to the orphans or a vulnerable group of children but only 0.14% of children are living in 585 childcare homes of 45 districts of Nepal. **Conclusion:** The adversity of losing parents at the tender age among orphans may lead them to develop depression. Though a huge number of orphans are tackling with various health problems, yet there are no special health and mental health policies that address the health of the orphans and the abandoned children in Nepal. The government and the supporting partners play a pivotal role in improving the mental health status of the orphans by reducing the barriers and improving their quality of life.

Keywords: Mental health, Depression, Orphan, Children

Introduction

Childhood is an important period for growth and development. Family and guardians play a vital role in the health and illness of their children. The growth and the survival of a child are severely affected due to the disturbance in the family environment owing to the loss of parents [1]. Orphans are those who have lost their parents and need special care. This special group of children is more vulnerable to developing a mental health problem [1,2]. Not only do children miss their physical presence when parents die, but also many psychological connections such as love, emotions, care, and protection. The adversity at this tender age without their parents may lead children to develop mental health problems such as depression [2].

This core group of children and a highly vulnerable group for mental health problems have the right to access physical as well as mental health services without any barrier. Besides these, data and research are scarce on depression among orphans in Nepal. This deficit of information about orphans has kept a question mark in improving the mental health status. As far our knowledge, there have been no studies till date to further explore the health status of orphan children in Nepal. So, there's plenty of space for the researchers to study different disease patterns, the mental health status among them and many more.

Methods

The literature review was done based on the information obtained from the grey literature and the published articles in national and international journals through web search in Pubmed and Google scholar. We searched the articles using various keywords such as depression, orphans, health problems in orphans, depression in children, depression in orphans, mental

health disorders in children and adolescents. The articles were selected based on three types of themes that is depression among general people, depression among orphans, and health system of Nepal focusing on depression and orphans. The final selection of the articles mainly focused on depression among orphans and its situation in Nepal. We restricted the search period to the past 10 years to be representative of the present prevalence of depression. However, there was no period limit for literature search that included articles relating to the health policies and laws.

Results

Mental health problem is a crucial public health problem and a serious issue that affects 13.0% of the world's population [3]. One in five (20.0%) children and adolescents suffer from some kind of mental disorders and it is predicted that the childhood neuropsychiatry disorder will rise to over 50.0% by the year 2020 which will be one of the most common reasons of morbidity, mortality, and disability [4,5]. Depression is a common mental health problem which has been affected by 300 million people worldwide [6] and the second most common cause of years lived with disability (YLD) in the world [7]. One in five people experiences depression at one point of their lifetime (8). According to the World Health Organization (WHO), globally, 4.4% (322 million) people were suffering from depression in 2015 which had increased by 18.4% from 2005 to 2015 [9].

The South-East Asia (SEA) region has the highest number of people living with depression which is around 27.0% and the overall prevalence rate of depression in this region is around 5.0% [9]. Nepal doesn't remain untouched with the global scenario. Around 12.8% population of Nepal suffer from mental disorder whereas 3.64% of Nepalese people suffer from depression [3]. Two studies reported the prevalence of psychiatric illness in Nepal according to which the prevalence of mental illness in Nepal was 37.5 % and that of depressive disorder was 13.2% in the rural setting of Nepal [10].

Depression is the most recurrent and preventable mental health problem in children with 17.0% prevalence in a lifetime [11] and it is high in orphan children [12]. United Nations Children's Fund (UNICEF), and global partners define an orphan as a child under 18 years of age who has lost one or both parents to any cause of death [13]. They might have lost their one or both parents for any reasons such as conflict, war, disaster, illness and poverty and have no one to care for them. The main threats of orphans are human trafficking, prostitution, forced labor, forced adaptation, child soldiers, organ mafia, missionaries, involvement in crime and substance abuse [14]. For healthy growth and development of the children, it requires love, care, protection, family environment, safety, and security. Access to food, shelter, education, and health care are the key challenges for orphan children [15]. According to UNICEF, in 2018, a total of 200 million children are orphans i.e. 2.5% of all children [16]. Among them, 61 million orphan children are in Asia. In Nepal, more than one million children are orphan [19]. The prevalence of children with one or both parents dead is 4.3% in Nepal [17]. Lack of care and support during the grieving process and inadequate environment without parents may lead to depression [2].

The prevalence of depression is 25.3% [18] in Acquired Immune Deficiency Syndrome (AIDS) orphan adolescents (10-19 years) in Northern Ethiopia, 20.0% in Orphan children of Egypt [2], 53.0% in 12 to 14 years orphan children and 46.0% in 15 to 17 years orphan children [19], 36.4% in orphan adolescent (15-19 years) of Ethiopia [20], and 24.1% in orphan children of South West Ethiopia [1] respectively.

Major depression is life long and recurrent [8]. It increases the risk of non-communicable diseases such as cardiovascular disease and diabetes [21]. Among the total disability, 10.0% of years lived with disability (YLD) accounts only from depression worldwide. Globally, eight hundred thousand people lose their life due to suicide [5] which is high among adolescents due to living in stress [22]. Suicide is the second most common cause of death in children, adolescents and young adults (5 to 24 years) due to depression [23] of which 75.0% occurs in developing countries (5) . Around 90.0% of suicide occurs as a result of mental health disorder and the depressed people are 20 times more likely to die from suicide than normal [24]. In major depression, people have 40.0 to 60.0% higher chance of suicide than general people [25].

Mental disorder in an adult is the result of the problems in childhood and adolescence [26]. Mental health problem causes other health problems as well. It prevents the mental and physical development, affects physical and social life, has poor sexual and reproductive health, has a disturbance in education and predisposes to violence [22], so depression is the barrier of sustainable development [6]. Apart from the health impact, depression causes economic consequences. In 2010, a total of US$ 800 billion economy was lost due to depression which was predicted to more than double by 2030 [27]. The cost of depression and anxiety disorders is more than US$1 trillion each year in the global economy [21]. Depression is the foremost cause of work disability worldwide. The depressive patients reduce their half of the productivity and cost is 27 days of work per year [28]. One study showed that 32.3% of people turned out their job because of depression [29]. Apart from the physical and economic impact of depression, it violated human rights, social and cultural rights, education rights, work and reproductive rights [25] and negative impact on the quality of life [30].

Depression causes a stressful life of people due to hormonal or biochemical alteration in the brain [31]. Depression is due to genesis and other factors experienced in life [6] such as lifestyle and health

behaviors, family history of illness, drug and alcohol misuse, unemployment, financial crisis, poverty, discrimination, social status, severe or long term stress, personal life history, death of near and dear ones, long term physical health condition, abuse, neglect, female gender, frequently changing foster, behavior of parents and other factors which causes depression and mental health disorder. Around 40.0% of the depression starts before 20 years [2,5].

Depression is more common in females than males, it is almost double [8,31]. One of the main reasons that predisposes to the major depression is the loss of parents which is almost double in comparison to other children. The orphan children have to be the victim of the inequality as they are treated differently by caregivers compared to their biological children [22]. The loss of parents, shift to the other house with new caretaker, fear about the future and the loss of school attendance cause depression in children [2]. Orphan children lose their parents and they have a lack of social connection, proper and complete education, and problem getting a job which predisposes to depression [22]. Indeed, orphans are a big challenge for developing countries [19].

Orphan children are a vulnerable and specific group of children. Children are the pillar of the nation, so their healthy growth and development is the primary concern of all societies [33]. Good education, health care, protection against physical and psychological abuse and other basic needs are the right of every child [14]. Family environment, happiness, love, and understanding are important for the harmonious development of children's personality [17].

On 7th April 2017, the WHO celebrated World Health Day on the high point WHO's year-long campaign " Depression: let' s talk" . In some way, it reduces the stigma of depression [34]. Nepal is committed to achieve the 3rd goal of the sustainable development goals (SDG) by 2030, reduce by one third, the premature mortality from non-communicable diseases through prevention and treatment and, promote mental health and well-being [35].

Mental health is a neglected and overlooked disease in Nepal. The government of Nepal is spending less than one percent budget on its total health budget (REF). And the health services are mainly concerned in the urban area and big cities with 0.22 psychiatrists and 0.06 psychologists per population of one lakh. The gap between mental health problem and treatment is 85.0% [5]. In 1996, Nepal launched National Mental Health Policy to ensure the fundamental right of mentally ill people by providing minimum health services to all the people of Nepal [36], but it needs extensive revision and implementation. Despite these big challenges, cases of mental health and depression are increasing especially in villages where there is a lack of mental health services. Public's beliefs, stigma, and knowledge affect the burden of depression [37]. These factors are more common on the orphan children.

Nepal is a developing and economically poor country which got indulged in long term social and political conflict for many years that significantly increased the number of orphans in the country. Nearly 2 million children were affected by the earthquake in 2015 in Nepal, which has left 320,000 children homeless. Many of them were left as an orphan. Around 34.0% of children were involved in some kind of child labor [38]. The constitution of Nepal 2015 and children' s Act 2018 have mentioned the right of the child stating that every child shall have the right to education, health, maintenance, proper care, sports, entertainment and overall personality development from the families and the state. Every child has the right to development and the child shall not be employed to work in any factory, mine or engaged in similar other hazardous work. Orphans are regarded as a special group of children and shall have the right to special protection and facilities from the state [36,37]. The government of Nepal established childcare homes to provide care, support, protection, education, security, health care, sports, recreational activities and other need to the needy children who don't have parents or are vulnerable children [41]. But only 0.14% of children are living in 585 childcare homes of 45 districts of Nepal. All children living in childcare homes are not orphan [42]. For this, we predict the situation of the living arrangement of the orphans and their right. The implementation of the act, law, and rule are not appropriate. Health-related policies such as the National Health Policy 2015 and Mental Health Policy haven' t included the physical and mental health of the orphan children.

A study in 2007 conducted among orphan children to assess the health status and health needs of orphans of Kathmandu valley, Nepal revealed that 93. 0% of children were sick at the time of study duration. The common diseases among the orphan children were; malnutrition (65.3%), coughing problem (22. 2%) , waterborne diseases (19. 4%) , skin disease (13. 4%) , disability (12. 0%) , ENT problem (12. 0%) , dental problem (8.0%), and other health problems (<5.0%) [43].

Conclusion

The adversity of losing parents at the tender age among orphans may lead them to develop depression. Studies conclude that almost half of the orphans are suffering from depression and it is almost double than the general children. Though a huge number of orphans are tackling with various health problems, yet there are not any special health and mental health policies that address the health of the orphans and the abandoned children in Nepal. The government and the supporting partners play a pivotal role in improving the mental health status of the orphans by reducing the barriers and improving the quality of life.

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