Chemical Pesticide Use and Quality of Life of Rubber Farmers in the Northeast of Thailand

Nippanon P,[1] SriruachaC,[2] Tantriratna P,[1] Phajan T,[3] Suwannaphant K,[3] Laohasiriwong W[1]

[1]Faculty of Public Health,

[2]Department of Health Administration, Health Promotion, Nutrition,

[3]Siridhorn College of Public Health,

Khon Kaen University, Khon Kaen 40002,

Thailand.

Corresponding Author

Chanaphol Sriruecha

Faculty of Public Health,

Khon Kaen University, Khon Kaen 40002,

Thailand.

E-mail: pirsri@kku.ac.th

Citation

Nippanon P, SriruachaC, Tantriratna P, Phajan T, Suwannaphant K, Laohasiriwong W. Chemical Pesticide Use and Quality of Life of Rubber Farmers in the Northeast of Thailand. *Kathmandu Univ Med J.* 2019;65(1):3-8.

ABSTRACT

Background

Chemical pesticide has known to have impacts on human health and environment. However, there are limited studies on chemical pesticide use has influence on quality of life (QOL) of rubber farmers in Thailand.

Objective

To determine the pesticide use and its association with quality of life of rubber farmers in the northest region of Thailand.

Method

This cross sectional study recruited the total of 362 samples by using a multi-stage random sampling from eight provinces in the Northeast of Thailand. A self-administered questionnaire was developed and used to collect the data. The multiple logistic regressions were used to determine the association between chemical pesticide use and quality of life when controlling other covariates, presenting adjusted odd ratio, 95% CI and p-value.

Result

Of the total 362 respondets, 66.57% of rubber farmers used chemical pesticides, only 32.60% had good quality of life (95% CI:27.75 - 37.45%). The multivariable analysis indicated that those who did not use chemical was associated with having good quality of life (adj. OR = 2.19; 95% CI = 1.34 to 3.58, p-value =0.002). Similarly, other factors associated with good quality of life were; working 6-7days/week (adj. OR = 1.75; 95% CI = 1.05 to 2.91, p-value = 0.031), had good attitude on rubber farming (adj. OR= 1.83; 95% CI: 1.071 to 3.14, p-value = 0.027, had low to moderate levels of stress (adj. OR=1.73; 95% CI: 1.017 to 2.67, p-value= 0.042) and had low level of knowledge on occupational health in rubber farming (adj. OR=1.66; 95% CI: 1.01 to 2.72, p-value = 0.044).

Conclusion

Most of the farmers used chemical pesticides, only one-third had good quality of life. Chemical pesticide use as well as work load, psychological factors and awareness on occupational health problems had influence on quality of life.

KEY WORDS

Chemical pesticide use, Quality of life, Rubber farmers

INTRODUCTION

Quality of life (QOL) is the extent to which individual perceived about comfort or satisfaction of their life in relation to their objectives, expectation, standards, and concerns. QOL involves health and happiness.[1] Therefore, it is worth assessing QOL of the people as wellbeing not only economic status. Para rubber (Hevea brasiliensis) has been widely cultivated in Asia, especially in Southeast Asia and has recently become an important economic crop in Thailand.[2] The rubber plantation has spread throughout the country, particularly in the South and lately the Northeast of Thailand. The nationwide rubber plantation covered 6,879,426.48 acres. Lately there have been rapidly expansion of rubber plantations in the Northeast which covered the area of 76,495.26 acres.[3] Para rubber famers are mostly using chemical pesticides putting them at a high risk of occupational exposures to pesticides occur during the production, transportation, preparation and application of pesticides in the workplace.[4,5]

Pesticides can cause hazard to farmers. These have been increasing health problems year by year, which have impact on quality of life among farmers.[6] In Thailand, the chemical pesticide use is in increasing trend. The Summary Report on volume and value of imported agricultural hazardous substances in Thailand was steadily increased from 2010-2015. The volumes of imported agricultural hazardous substances were 117,815 tons in 2010 and was increased to 149,546 tons with the value of 19,326 million baths in 2015.[3]

In 2014, the prevalence of health problems related to pesticides use in Thailand was 12.25 per population 100,000 persons, which slightly increased from 2013. The prevalence of pesticide use related health problems was highest among farmers planting cash crops and vegetable groups (36.02%) followed by other general workers (26.31%). However, the quality of life related with pesticide use has never been investigated. Therefore, the researcher aimed to study chemical pesticide use, quality of life and its association of rubber farmers in the Northeast of Thailand.

METHODS

This cross-sectional study was conducted in 3 provinces of the Northeast of Thailand namely Loei, Nongkai, and Bungkan. The respondents aged 20 years old or more, have lived in the Northeast of Thailand and could verbally communicate with the researchers as well as agreed to participate by providing written inform consent were included in the study. However, perticipants having severe impairment and/or having mental illness, which limited their communication with the researchers were excluded. A total of 362 Sample was calculated based on multiple logistic regression formulation to find the correlation in multivariate by using multiple logistic regression.[7]

$$n = P(1-P)(Z_{1-\alpha} + Z_{1-\beta})^2 / \left[B(1-B)(P_0 - P_1)^2\right]$$

A multistage random sampling method was used to select participants in the Northeast of Thailand. Firstly, 3 provinces were selected by using simple random sampling method; Loei, Nongkai, and Bungkan provinces. Then, one district was randomly selected from each province; Erawan, Phon Phisai and Si wilai districts. Thirdly, one tumbon was selected by using simple random sampling method from each district, these tumbons were Sap Phaiwan, Chumphon and Na Saeng. One village of each tambon were sampled by using clustered random sampling to select all participants who met the inclusion criteria proportionally to size of the samples added to the total of 362 samples. This research proposal and tools got approval from the Khon Kaen University Ethics Committee in Human Research (HE 582244). Written informed consent was gathered from all participants before data collection.

A structured questionnaire, which was developed from reviewing literatures based on researched questions. The questionnaire consisted of 7 sections and one open ended question. Section A of the questionnaire was comprised of thirteen items intended to gather information regarding demographic factors, Section B was specification designed for working experiences, Section C covered the ergonomic, psychosocial and environmental factors, Section D assess the knowledge on occupational health and safety in rubber plantation, Section E was on the attitude in rubber plantation, Section F assess the work related stress, Section G was the WHOQOL-BREF and Section H was open questions asking for problems and suggestions. The questionnaire was undergone content validation by 5 experts and was revised to improve validity. The questionnaire was tested for reliability using Cronbach's alpha amongst 30 participants who had similar characteristics with the samples who were rubber workers in Khon Kaen province. The Cronbach's alpha coefficient was 0.84.

QOL was assessed using the Quality of Life scale (WHOQOL - BREF) of WHO Thai short version. It is consisted of 26 items, which covers 4 domains containing physical, psychological, social relationships and environment domains. The scores were categorized into 3 groups: poor level (26-60 scores), fair level (61-95 scores) and good level (96-130 scores). Since the multiple logistic regression analysis of Hsieh is for the dichotomous outcome. Therefore, in the bivariate and multivariate analysis we dichotomized the QOL as good QOL and poor/fair QOL, using cutoff point of below 96 for poor/fair QOL and 96 or above for good QOL.

STATA® (ver. 13; College Station, TX, USA: Stata Corp) was used to analyze the data. The categorical data were presented as frequency and percentage whereas the continuous data were explained using their magnitude as mean, standard deviation, median, and range.

Bivariate analysis was utilized to define the association of each independent variable with QOL. Any independent

variables, in the bivariate analysis that had p-value < 0.25 were chosen and further analyzed by the multivariable analysis. Then the p value <0.05 was considered as significant.

Multiple logistic regression was used to determine the association between factors and QOL while controlling covariates. The final model results presented the magnitude of association of independent variables and QOL were adjusted odds ratio (adjusted OR), and its 95% CI.

RESULTS

Majority of the samples were male (53.59%) with the average age of 46.05 ± 10.75 years old. Almost all were married (93.09%), the highest proportion finished only primary school (37.85%). Their median family monthly income was 533.37 USD (min: max: 60.96 – 9,143.54). However, their median family monthly income from Para–rubber was 304.78 USD (min: max: 18.29-3,047.85). Almost all had sound financial situation with no debt (99.72%) (Table 1).

Table 1. Demographics among rubber farmers in the Northeast of Thailand (n=362)

Demographics data	Number	Percent
Gender		
Male	194	53.59
Female	168	46.41
Age (years)		
<30	29	8.01
30-39	65	17.96
40-49	130	35.91
50-59	101	27.90
≥60	37	10.22
Mean (SD)	**46.05(10.75)**	
Median (Min, Max)	**46 (20,75)**	
Marital status		
Single	8	2.21
Married	337	93.09
Divorce	17	4.70
Educational attainment		
Non-formal education	25	6.91
Primary school	137	37.85
Junior high school	77	21.27
High school/vocational certificate	92	25.41
Diploma	31	8.56
Average monthly family income (USD)		
< 152.39	10	2.76
152.39 – 304.77	44	12.15
304.78 – 457.15	92	25.42
457.16 – 609.54	42	11.60
≥609.55	174	48.07
Mean (SD)	**827.71 (1,014.98)**	
Median (Min, Max)	**533.37 (60.96 - 3,047.85)**	
Average monthly income from Para rubber plantation (USD)		
< 152.39	31	8.56
152.39 - 304.77	98	27.07
304.78 - 457.15	88	24.31
457.16 - 609.54	40	11.05
≥609.55	105	29.01
Mean (SD)	**441.26 (374.22)**	
Median (Min-Max)	**304.78 (18.29 - 3,047.85)**	
Debt		
Do not have	1	0.28
Having	361	99.72
Volume of debt (USD)		
< 1,523.92	92	25.41
1,523.92 – 3,047.84	64	17.68
3,047.85 – 4,571.76	52	14.36
4,571.77 – 6,095.69	83	22.93
≥6,095.70	71	19.62
Mean (SD)	**4,023.58 (4,656.75)**	
Median (Min:Max)	**3,047.85 30.48: 30,478.48)**	
Type of debt		
Formal	257	89.86
Informal	29	10.14

Most of the Para rubber farmers had moderate level of QOL (61.88%; 95% CI: 27.78 -37.69). However, almost one third of them had high level of QOL (32.60%; 95% CI: 27.75 – 37.45) and Only 5.52% (95% CI: 3.40 - 8.40) had low level of QOL (Table 2).

Table 2. Number and percentage of prevalence of Quality of life among rubber farmers in the Northeast of Thailand (n=362)

Level of Quality of Life	Number	Percent	95% CI
Low level	20	5.52	3.40-8.40
Average level	224	61.88	56.65-66.90
High level	118	32.60	27.78-37.69

About two-thirds of the rubber farmers used chemical pesticide (66.57%). The most common use of the chemical was organic fungicides (33.43), absorption type of pesticide (glyphosate, 23.48%) and Paraquat which is a trade name of Gramoxone (17.68%) (Table 3). Majority of these farmers used boots while spraying the chemical pesticide, 18.23% and 11.38% wore gloves and masks respectively. However, only 9.39% wore chemical protective clothing (CPC) (Table 3).

Table 3. **Number and percentage of chemical pesticide and protective equipment use among the rubber farmers in Northeast of Thailand (n=362)**

Pesticide and protective equipment use	Number	Percentage
Chemical Pesticide Use		
Use	241	66.57
Not use	121	33.43
Type of Pesticide		
Chemical Fungicide	92	25.41
Absorption : Glyphosate	85	23.48
Gramoxone : Paraquat	64	17.68
Organic	121	33.43
Protective equipment used to prevent pesticide exposure		
Boots	219	61.00
Gloves	66	18.23
Mask	43	11.38
Chemical Protective Clothing (CPC)	34	9.39

Crude Analysis on the association between individual factors and good QOL of the rubber farmers by using bivariate analysis presenting crude odds ratio, 95% CI and p-value. The factors that had p-value < 0.25 were proceeded to multivariable analysis. Factor associated with having good quality of life of rubber farmer were did not use pesticide (OR= 2.11; 95% CI: 1.33 to 3.34; p-value = 0.001), had good attitude on rubber farming (OR= 1.84; 95% CI: 1.071 to 2.83, p –value = 0.027), had low level of knowledge on occupational health in rubber farming (OR= 1.75; 95% CI: 1.09 to 2.83, p-value = 0.020), had low levels of stress (OR=1.84; 95% CI: 1.07 to 3.14; p-value = 0.023), Smoking (OR= 1.63; 95% CI: 0.93 to 2.86; p-value = 0.087), had chronic diseases (OR= 1.39; 95% CI:0.89 to 2.16; p-value = 0.143), were females (OR= 1.30; 95% CI: 0.85 to 2.36; p-value =0.23, working in para-rubber plantation 6-7 days per week (OR= 1.23; 95% CI: 0.78 to 1.93; p-value = 0.354), drunk alcohol (OR= 0.74; 95% CI: 0.46 to 1.20; p-value = 0.229) (Table 4).

The multiple logistic regressions by Backward elimination technique indicated that rubber farmers who did not use chemical pesticides were 2.19 times of having good quality of life when compared to those who used chemical pesticides (adj. OR = 2.19; 95% CI = 1.34 to 3.58, p-value = 0.002). Other factors that were also associated with having good QOL among the rubber famers were had good attitude on rubber farming (adj. OR= 1.83; 95% CI: 1.07 to 3.14, p -value = 0.027), worked 6-7day/week (adj. OR= 1.75; 95% CI: 1.05 to 2.91, p-value = 0.031), had low to moderate levels of stress (adj. OR=1.73; CI: 1.017 to 2.67, p-value = 0.042), had low level of knowledge on occupational health in rubber farming (adj. OR= 1.66; 95% CI:1.01 to 2.72, p-value = 0.044) (Table 5).

Table 4. **Factors associated with QOL among rubber farmers in the Northeast of Thailand: Bivariate analysis (n=362)**

Factors	% Good QOL	OR	95 % CI	p-value
Chemical pesticide use				
Use	26.97	1	1	0.001
Not use	43.80	2.11	1.33 to 3.34	
Level of attitude on Para rubber plantation				0.016
Poor to Average	29.20	1	1	
Good	43.18	1.84	1.12 to 3.02	
Knowledge levels				0.020
Medium to high	25.00	1	1	
Low	36.96	1.75	1.09 to 2.83	
Stress levels				0.023
High- Severe	28.69	1	1	
Low- Moderate	40.68	1.70	1.07 to 2.70	
Smoking				0.087
Smoking	24.69	1	1	
Not smoking/smoked but quitted	34.88	1.63	0.93 to 2.86	
Chronic Diseases				0.143
Have	29.52	1	1	
Does not have	36.84	1.39	0.89 to 2.16	
Gender				0.239
Male	29.90	1	1	
Female	35.71	1.30	0.85 to 2.36	
Number of day per week working in para-rubber plantation (Days)				0.354
1-5 days	30.77	1	1	
6-7 days	35.46	1.23	0.78 to 1.93	
Alcohol Consumption				0.229
Drink	34.73	1	1	
Not Drink	28.46	0.74	0.46 to 1.20	

DISCUSSION

This study was conducted to determine the QOL and the association between chemical pesticide use and QOL of the Para rubber farmers in the Northeast of Thailand. The samples were selected using random sampling and almost equal proportion of males and females. They were in the middle aged with quite good economic status of both income for Para rubber and other crops. About two-thirds of the respondents used chemical pesticide (66.57). Only 32.60% had good QOL. It was also found that the Para rubber who did not use chemical pesticide were as having strong association good QOL i.e about 2 times higher odds. Other covariates that were also associated with good QOL were working 6-7 days/week, had good attitude on rubber farming, had low to moderate levels of stress and had low level of knowledge on occupational health

Table 5. The factors associated with quality of life among rubber farmers in the Northeast of Thailand: Multivariable Analysis (n=362)

Factors	% Good QOL	OR	adj.OR	95 % CI	p-value
Chemical pesticide use					0.002
Use	26.97	1	1	1	
Not use	43.80	2.11	2.19	1.34 -3.58	
Attitude level					0.027
Poor to moderate	29.20	1	1	1	
Good	43.18	1.84	1.83	1.07 - 3.14	
Number of day per week working in para-rubber plantation (Days)					0.031
1-5	30.77	1	1	1	
6-7	35.46	1.23	1.75	1.05 -2.91	
Stress level					0.042
High to severe	28.69	1	1	1	
Low to moderate	40.68	1.64	1.73	1.02 -2.67	
Level of knowledge on occupational health					0.044
Moderate-high	25.00	1	1	1	
Low	36.96	1.75	1.66	1.01 -2.72	

in rubber farming. These famers were in sound financial status (median monthly income of 304.78 USD (min: max: 18.29 -3,047.85). In addition, almost all had no debt. This finding is similar to the results found in the study of Yupaporn Chunpimon indicated that Para rubber farming had positive influence on the livelihoods of farmers, raising their income.[8]

Chemical pesticide use was found associated with QOL of which did not use chemical pesticide had strong influence on good QOL of rubber. This finding is consistent with past research finding from Songkhla Province.[9] Pesticides are known to cause various signs and symptoms both short term such as dizziness, nausea and vomiting and associated with some chronic diseases. Almost haft of these sample suffering chronic diseases. Therefore, only a quarter of them had good QOL. Had good attitude on rubber farming was also found associated with good QOL. This result was supported form Suton Manasuwan and Suwat Mahatnisunkul.[10,11] The influence of good attitude on rubber farming might also related to other factors which was low to moderate levels of stress that also associated with good QOL. When people have good attitude they are more likely to be able to enjoy or adapt themselves better, have less stress that affect the QOL. This finding was found to be in accordance to the pesticide exposure, safety issues, and risk assessment indicators study and World Health Organization Quality of Life Group.[12,13] Their findings were: workers who had high levels of stress had higher chances to have musculoskeletal disorders 1 (95% CI: 1.1 to 1.4). The finding of the World Health Organization Quality of Life Group indicated that stress (psychological domain) effect the happiness in life.[13]

The rubber farmers who having worked 6-7 day/week had significant higher QOL than those who worked fewer days. This result were supported by others including those studied in Yua Bann kluang Sub-district, Thauthen District, Nakhonphanom Province.[14-16] Those who could work more days per weeks may be healthier than others, the more days they work could generate more income and better living conditions. However, it was found that the Para rubber farmer who had lower level of knowledge on occupation and safety had higher chances of having good quality of life (when compared with those with moderate and high levels of knowledge. It may be because those with lower level of knowledge on occupational risks may have less concern and seldom worry much on their health and safety, they therefore have less stress, which resulted in better QOL.

This present study was conducted among the rubber farmers of 3 provinces of the Northeast of Thailand which represents rubber farmers of northeast of Thailand. Although this cross-sectional study could not illustrate the causal relationships of risk factors and the study outcomes. Therefore, further longitudinal study will required to find out the causal relationship among the study population.

CONCLUSION

This study concludes that most of the farmers used chemical pesticides. Of the total 362 respondents only one-third had good QOL. In addition, chemical pesticide used as well as work load, psychological factors and awareness on occupational health problems had influence strongly likely to decorate the QOL. Therefore, appropriate pesticide use behaviors, that reduces pesticide exposure, are in need or farmers during preparation and usage.

ACKNOWLEDGEMENTS

This project was made possible with the contribution of Para rubber famers in the Northeast of Thailand and funding from the Research and Training Center for Enhancing Quality of Working Age People, Khon Kaen University, Thailand.

REFERENCES

1. Vahedi S. World Health Organization Quality-of-Life Scale (WHOQOL-BREF): analyses of their item response theory properties based on the graded responses model. *Iranian journal of psychiatry*. 2010;5(4):140.
2. Balsiger J, Bahdon J, Whiteman A. The utilization, processing and demand for rubberwood as a source of wood supply: Forestry Policy and Planning Division Rome; 2000.
3. Department of Agriculture OoA. Quantity and import value of chemical pesticides (internet) 2015 [cited 2015 15 July 2015]. Available from: http://www.oae.go.th/ewt_news.php?nid=146.
4. Damalas CA, Eleftherohorinos IG. Pesticide exposure, safety issues, and risk assessment indicators. *International journal of environmental research and public health.* 2011;8(5):1402-19.
5. Maroni M, Fanetti AC, Metruccio F. Risk assessment and management of occupational exposure to pesticides in agriculture. *La Medicina del lavoro.* 2006;97(2):430-7.
6. Donaldson D, Kiely T, Grube A. Pesticide's industry sales and usage 1998-1999 market estimates. US Environmental Protection Agency; Washington (DC): Report No. EPA-733-R-02-OOI. Available from: http://www. epa. gov/oppbead/pesticides/99 ..., 1997.
7. Hsieh FY, Bloch DA, Larsen MD. A simple method of sample size calculation for linear and logistic regression. *Statistics in medicine.* 1998;17(14):1623-34.
8. Yupaporn Chunpimon CJ, Wanpen SungKum. Health Status and Health Preventive Behaviors among Rubber Plantation Workers. *Journal of Health Science.* 2008;16(2):390-9.
9. Phechnoy Singchongchai. The Quality of Life of local labor rubber industry and trade: Songkhla Province. *AL-NUR JOURNAL OF GRADUATE SCHOOL, FATONI UNIVERSITY.* 2013;8(14):1-8.
10. Manasuwan S. The Quality of Life of public health and intelligence among Thai muslims in rural community: case study Mew Yvette subdistrict, Yarang district, Pattani province. Faculty of Social Development Thesis: National Institute of Development Administration; 1998.
11. Suwat Mahatnisunkul SP, Wanida Pumpaisanchai. The Quality of Life of Thai in Economic crisis. Chiangmai: Hospital S; 1997.
12. Dasinger LK, Krause N, Deegan LJ, Brand RJ, Rudolph L. Physical Workplace Factors and Return to Work After Compensated Low Back Injury: A Disability Phase-Specific Analysis. *Journal of occupational and environmental medicine.* 2000;42(3):323-33.
13. World Health Organization. The world health organization quality of life (WHOQOL)-BREF. 2004.
14. Inthayotha P. The Quality of Life of Rubber Farmers: Study report. Bangkok: Aid TOotRR; 2004.
15. Promsui P. quality of life of rurul people: Case study in Yua Bann kluang Subdistrict, Thauthen District, Nakhonphanom Province. 2001.
16. Research Office NIoDA. The Quality of Life of Thais 2010. Bangkok: Administration NIoD; 1997.