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Effect of Aircraft Noise Level on Increased Serum Cortisol Level among Ground Handling Workers at JuandaAirport

Muhammad Zulfikar Adha[1], Jojok Mukono[2], Soedjajadi Keman [3]
Master Program Research, Environmental Health Department, Public Health Faculty
Airlangga University, Surabaya, Indonesia [1]
Environmental Health Department, Public Health Faculty, Airlangga University, Surabaya, Indonesia[2,3]
Email: muh.zulfikaradha@yahoo.com[1]

Abstract-Aircraft noise exposure can lead to non-auditory effects such as job stress that is characterized by increased cortisol in blood. Increased cortisol is immunosuppresive effects.. Objectives of this research was analyzing effects of aircraft noise level on increasedcortisol among ground handling workers. Methods of this research was analytical observational with cross sectional study. Research respondents were 12 workers in each group of ground handling workers and check-in workers. Aircraft noise level were measured with *Sound Level Meter brand Svantex type 917*. Serum cortisol was analyzed with Elisa method. Results showed that noise level in apron area in Juanda Airport exceed NAB noisy workplace was 88,2 dBA, while noise level in check-in room is under NAB noisy workplace was 62,2 dBA. Aircraft noise and period of work increasing serum cortisol levels (linear regression; p=0,00 and p=0,00).Conclusions of this research is aircraft noise and long working hours affect on increased serum cortisol levels. The suggestion of this research is conducting periodic monitoring of noise intensity every 1 month on the apron area. Workers at the terminal are advised to take sufficient resting, recreation and exercise regularly to avoid the stress of work.

Index Terms*:*Aircraft Noise, Serum Cortisol Level, Ground Handling Workers,Juanda Airport.

1. INTRODUCTION

Air transport as one of the transport has the advantage in speed and cruising range make the aircraft as transportation is increasingly needed. But in the development of aircraft also poses special problems concerning noise [1].

Airport as a meeting place of all flight activity is one of the sources with potential to pollute the air, especially in terms of noise. The main noise source located at the airport comes from jet engines that have a high frequency and large sound intensity which is about 90-110 dBA or more [2].

The number of passengers from various airports in Indonesia increased in 2014 reached 72.6 million, up 5.6% from the year 2013 as many as 68.5 million people. Increasing the number of air passengers is highest in airports Juanda amounted 16.32% [3].

Impact of air traffic movements are very crowded will cause noise on the activity of workers, especially at airport officials especially airport apron. Exposure to noise emanating from the aircraft can lead to acute stress and chronic stress on ground handling workers in charge of organizing the best events and other activities in the courtyard area airports [4].

Stress due to exposure to noise can cause *Adrenal Medullary Sympathetic* reaction system (SAM system), the *Hypothalamic Pituitary Adrenocortical* (HPA) system and other endocrine system [5].

Noise causes stress reaction through increased *Corticotrophin Releasing Hormone* (CRH), which is triggered by the activity of the HPA axis is located in the hypothalamus. Increased secretion of CRH causes the release *Adrenocorti-Cotrophin Hormone* (ACTH). ACTH then activate the biosynthesis process and the release of glucocorticoids such as cortisol from the adrenal cortex [6].

Steroids have many important functions that affect on receptor mediated gene expression and regulation of the body in general as well as the setting up of energy and metabolic changes necessary for the organism to stressors coping process [7].

Cortisol is a public health enemy number one. Scientists have known for years that increased levels of cortisol can interfere with learning and memory, immune function and lower bone density, increased body weight, blood pressure, cholesterol, heart disease and others [8].

Activities serum cortisol in the body is influenced by characteristics such workers, age, period of work and body mass index (BMI). The purpose of this research was to look at the effect of aircraft noise on serum cortisol levels in ground handling workers Juanda airport.

2. METHOD

This Researchers was research design using analytic observational with cross sectional design.

Population in this research were all ground handling workers (exposure group) Juandaaiport. As a comparison group is administration staff(exposure group). The research sample consisted of 12ground handling and 12 administration staff.

Blood serum taken aims to determine the level of cortisol measured aim to determine the condition of stress hormone workers. Examination of kortisol in blood serum using human kortisol ELISA kit with ELISA high sensitivity methods.Aircraft noise level were measured with Sound Level Meter brand Svantex type 917.Technique data collecting by interview using a questionnaire about age, period of work, and mass body index.

Cortisol is dependent variable. Meanwhile, Aircraft noise as independent variables. Age, period of work, and mass body indexas confounding variable.The multiple regression was used for determination of the association between Aircraft noise exposure, age, period of work, mass body index with the serum kortisollevels. And independent sample t test was used for difference in levels of serum cortisol exposed group and unexposed group. Result were considered to be statistically significant at $p < 0,05$.

3. RESULT

Respondents of this research is ground handling workers and administration staff Juanda airport with the criteria of the male sex, didn't have problems in workplace, doesn't have a hearing loss and doesn't have a historychusing syndrome. Characteristics of workers can be seen in Table 1.4:

Table 1.Characteristicsof Ground Handling Workers and Administration Staff based on Age, Period of Work, and Mass Body Index

Characteristics Workers	Ground Handling Worker		Administration Staff	
	n	%	n	%
Age (Years)				
21-25	4	33,33	7	58,33
26-30	5	41,67	4	33,33
>30	3	25	1	8,34
mean±SD	29,25±8,59		26,33±4,39	
Period of Work				
≤5 years	8	66,67	7	58,33
>5 years	4	33,33	5	41,67
mean±SD	4,05±2,61		5,21±1,87	
Mass Body Index				
Less (<18,5)	3	25	0	0
Normaly(18,5-25,0)	8	66,67	6	50
Obesity (>25,1)	1	8,33	6	50
mean±SD	21,90±3,12		24,84±3,81	

Table 1 showed that ground handling workers had a mean age of 29.25 years with mean period of work 4.05 years and mean body mass index of 21.90 kg / cm2 including the category of normal weight. whereas the administration staff had a mean age of 26.33 years, with period of work5.21 years and body mass index of 24.84 kg / cm2 including normal weight.

Noise intensity measurements conducted at two locations, namely, the airport apron and Juanda airport passengers check in room. Based on Minister of Manpower and Transmigration Republic of Indonesia Number 13 Year 2011 on the value of noise limits for 8 hours / the day is 85 dBA[9].

Table 2.Noise Levels in Apron danPassengers Check-in Roomat JuandaAirport

Measurements Location	Leq 8 hours (dBA)
Apron Area	88,2
Passengers Check-in Room	62,2

Results showed that noise levelfor 8 hours in apron area in Juanda Airport exceed noise limits workplace was 88,2 dBA, while noise level in check-in room is under noise limits workplace was 62,2 dBA.

Increasing levels of serum cortisol in the blood is a marker for the occurrence of work stress. The results of the examination levels of cortisol can be seen in Table 3

Table 3.Serum Cortisol Levelson the examination results of Ground Handling Workersand Administration StaffJuandaAirport

Workers	Cortisol(µg/dl)	
	mean±SD	p
Ground handling	12,26±5,16	0,00*
Administrasi Staff	7,01±2,45	

*****ρ<0,05 = significant

Table 3 showed that serum cortisol levels in ground handling workers is higher than the cortisol level administration staff. There are differences serum cortisol levels are very significant between ground handling workers and administration staff (ρ <0.05). This is because the ground handling workers exposed to noise intensity is large enough to cause work stress.

Table 4.Analysis Effect of Aircraft Noise againstSerom Cortisol Levels in Ground Handling Workers at AiportJuanda

Variable	Serum Cortisol Levels	
	b	p
Aircraft Noise	0,416	0,00*
Age	-0,975	0,34

Period of Work	-0,563	0,00*
Mass Body Index	-0,118	0,44

*ρ<0,05= significant

Result ofmultiple linear regression analysis showed that aircraft noise affect serum cortisol levels (b = 0.416; ρ = 0.00), where the higher the noise aircraft noise exposure, the greater increased serum cortisol levels in the blood.

Table 4 showed that period of work affect the increased serum cortisol levels (b = -0.563; ρ = 0.00). Results of multiple linear regression analysis above imply lower a person's period of workwill increase the level of cortisol in the blood. As for the variables of age and body mass index don't show the effect of the increased levels of serum cortisol ground handling workers and administration staff.

4. DISCUSSION

Noise is unwanted side products of environment that caused the operations of the airport that is voice of aircraft engines that generate noise affects activity of ground handling workers. Exposure to continuous noise from activities at the airport environment can lead to various psychological disorders, whichone job stress [10].

Diagnosing stress due to work very hard indeed. Questionnaire has been widely used as a measuring tool one example the questionnaires Hars (Hamiliton Anxiety Rating Scale). Questionnaire measuring instrument has a weakness for diagnosing a person experiencing stress or not, because of the honesty of respondents would be devastating to determine the outcome. Diagnosis of stress on a person with a measuring tool of hormone cortisol in the blood serum results are potentially more accurate than questionnaire. Because blood is most accurate biomarker to describe a person's stress due to exposure to noise [11].

This research showed airport noise effect increased levels of cortisol ground handling workers. These results are consistent with research conducted Nawaz that mean cortisol levels of noise exposed group with intensity> 95 dBA, which is higher (35.16 ug / dl) than levels of cortisol in the unexposed group to noise (25.39 ug / dl) [12].

Intensity noise exposure is quite high and continually have a tendency to increase secretion of hormone cortisol, which is caused by body's response to a stressor. Hans Selye concept of General Adaptation Syndrome (GAS) describes how stress that occurs will be responded body into three stages: alarm stage, adaptationstage, and exhaustion stage [13].

Mechanism of increased levels of cortisol due to noiseexposure occurs in the body's response first phase of the alarm stage. In the alarm stage, noise exposure will be responded as stressors and will be caught by the cell *paraventricular nucleus* (PVN) and cells *locus cereleus nor adrenergic center* in the hypothalamus. Both of these cells undergo activation or stress phase 1, which secrete CRF. The molecule sends signals to cells in pituitary to secretionACTH. Pituitary cell experiences stress or activation stage 1. ACTH then captured by cells in cortex of adrenal glands which then secretion cortisol and adrenal medulla cells experience stress stage 1 or stage activation [14].

This research also shows period of work affects increased serum cortisol levels. Of the 12 respondents who researched exposure group, have an average period of workunder 5 years with a percentage of 66.27%. The results are consistent with research conducted by Swee et al., Examined work stress on international tobacco company workers in Malaysia. Based on his research, it was reported that the service life of the workplace is a factor that was significantly associated with work stress on staff management companies [15].

Period of work is usually accompanied by increased employment experience can influence in the face of perceived job stress workers. Proficiency is one factor intrinsic stressors acquired by workers through experience on the job. The experience can reduce job stress on labor [16].

Ground handling workers have a fast working very risk to have elevated levels of cortisol in the blood. This occurs because person body's response to noiseexposure. Hans Selyeconcept of the General Adaptation Syndrome (GAS) explain to workers who have a period of work, his response has reached a stage 2 the adaptation stage. In the adaptationstage, although the noise exposure is given, there will be a process of adaptation, as indicated by a decrease in cortisol levels approaching normal. However, for workers who have working period of rapid, possible responses of his body is still in the alarm stage and has not reached the stage adaptation process resulting in increased levels of cortisol in the blood.

5. CONCLUSION

Conclusion of this research is serum cortisol levels in ground handling workers higher than administration staff at Juanda airport. Aircraft noise and period of work affect on increased levels of serum cortisol ground handling. High serum cortisol levels indicate occurrence of job stress on ground handling workers Juanda airport.

6. SUGGESTION

The suggestion of this research is conducting periodic monitoring of noise intensity every 1 month on the apron area. Workers at the terminal are advised

to take sufficient resting, recreation and exercise regularly to avoid the stress of work.

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