



## INTERVAL TRAINING OF 2 X 800 METERS BETTER THAN 4 X 400 METERS IN INCREASING PHYSICAL FITNESS OF BPBD OFFICERS IN DENPASAR-BALI

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### ABSTRACT

Physical fitness is something that must be owned by employees of the Regional Disaster Management Agency (Badan Penanggulangan Bencana Daerah / BPBD). Evaluation results show that the level of physical fitness of BPBD employees is still lacking. This is because the training methods applied are not appropriate. For this reason, research needs to be conducted to find the right training methods to improve physical fitness. This study used a randomized pre and post test control group design design involving 27 BPBD Denpasar staff as samples. Of this amount then allocated into 3 groups. Group-1 (Control Group) is given the old model training, namely line-up training, Group-2 is given 2 X 800 meter interval training interspersed with the road for 6 minutes, and Group-3 is given 4 X 400 meter interval training, interspersed with the road for 2 minutes . The duration of training is 8 weeks with a frequency of 3 times per week. The difference in mean travel time of running 2.4 kilometers between pre-posttest in each group was tested by t-paired while the mean difference between the three groups was tested by ANOVA test. The next test is the Post Hoc LSD test on significance ( $\alpha = 0.05$ ). From the analysis of the data it was found that Group-1 only gave an increase in physical fitness by 4.5% ( $p > 0.05$ ), Group-2 gave an increase of 22.7%, ( $p < 0.05$ ), and Group-3 provided an increase of 13.9% ( $p < 0.05$ ). The difference in physical fitness improvement between Group-1 and Group-2 was 18.89% ( $p < 0.05$ ), between Group-1 and Group-3 was 9.84% ( $p < 0.05$ ), and between Group-1 with Group-3 at 10.11% ( $p < 0.05$ ). So the 2 X 800 meter interval training is better than the 4 X 400 meter and the Control Group

in improving physical fitness. Where Group-1 is in the poor category, Group-2 is in the good category, and Group-3 is in the moderate category.

**KEYWORDS:** BPBD officers, interval training, physical fitness.

## INTRODUCTION

One of the problems now faced by Denpasar City is the increasing threat of fire. Data in the Denpasar BPBD shows the average number of fires from 2015 to 2020 reaching 733 fires with losses reaching 301.528 billion rupiah. This total loss reached 35 percent of the total budget of the original city of Denpasar in 2020 which amounted to 924.70 billion rupiah. The most dominant causes of fire are short-circuit electricity, the use of stoves, cigarette butts and several other causes.

Referring to the Performance Improvement Program of the Denpasar BPBD Fire Danger Officer (2016-2026). Which explains that the new paradigm of local government demands the implementation of a basic element of government philosophy that increasingly leads to the composition of "small, strong but effective and efficient". In order to carry out its functions properly, the basic elements that must receive attention include apparatus, government organizational structure, regulations that are used as a basis for moving and culture or work culture with high ethos values (BPBD, 2019).

To meet these demands, the 2016-2026 Work Program has been established, namely (BPBD, 2016): 1). Consolidation of main tasks and functions, dissemination and publication of fire prevention programs, work monitoring and evaluation. 2) Procurement of facilities and infrastructure, to complement the 15 existing fleets. Planned the addition of multipurpose cars as operational support units for fire engines and portable pump machines for terrain that are difficult to reach by fire trucks. 3). Improving the quality of human resources, with the aim of improving skills and maintaining the alertness of fire personnel in an excellent manner.

Recognizing the importance of physical abilities for a fire officer, efforts are needed to improve it. Physical fitness is a capability or adaptation to the physical burden faced without causing significant exhaustion (Hopkins, 2002). With excellent physical fitness, work motivation will increase and appreciation of the task increases. Thus, training must be given regularly and continuously. There are also those who argue that regular and continuous training will increase the efficiency of the work of the heart, the efficiency of the work of the

lungs. number and size of blood vessels, blood volume, muscle tone and blood vessels, decreased body fat, maximum oxygen consumption and increased outlook on life, reduce obesity and as a treatment for certain diseases (Nala, 2015).

The choice of training model in this study is based on the tasks faced by fire officers. Based on observations, when tackling fires that took  $\pm 2$  hours, officers always ran and walked from one place to another, especially since the location of the fire could not be passed by four-wheeled vehicles. They run interspersed with walking that can reach a distance of  $\pm 1000$  meters. In accordance with these tasks, a model of interval running aerobics training was chosen namely 2 X 800 meter interval training and 4 X 400 meter interval training to improve the physical fitness of Denpasar BPBD officers.

According to Nala (2015), physical fitness depends on 2 large groups, namely static fitness and dynamic freshness. Both groups are very important in overall physical fitness and the interaction between them determines the level of physical fitness. Components of physical fitness include: strength, endurance, speed, agility, energy, flexibility, balance and coordination. Muscle strength, muscular endurance and heart endurance are three important elements in physical fitness. To run 2.4 km required endurance of the heart and endurance of muscles (Purba, 2014). Therefore, an examination of the physical fitness of Denpasar BPBD personnel was examined. The training that was tried was 2 X 800 meter interval training and 4 X 400 meter interval interval training. Then the results will be measured after exercise for 8 weeks.

## MATERIALS AND METHODS

This study uses a Randomized Pretest and Post Test Control Group Design (Pocock, 2008). Where the three groups were measured physical fitness before and after treatment by running as fast as possible to cover a distance of 2.4 kilometers. Then the results are compared. A sample of 27 people was divided at random by simple, so that each group numbered 9 people. Group-1 was given training in the old model of running ie lines lined up for  $\pm 10$  minutes before morning apple, playing table tennis without measure. Group-2 was given a training interval of 2 X 800 meters interspersed with the road for 6 minutes starting with heating and stretching for 10 minutes. Then the subject ran for 6 minutes with a distance of 800 meters with a 6 minute walk interval with a distance of 420 meters. After training, it will cool down for 5 minutes. Group-3 was given a training interval of 4 times 400 meters, interspersed with a walk for 2 minutes starting with heating and stretching for 10 minutes. After warming up

the subject ran for 2 minutes at a distance of 400 meters with an interval of 140 meters for 2 minutes. The next phase is cooling for 5 minutes. The study was conducted in the afternoon at 16.00-17.30 in the Renon Puputan field in Denpasar. Furthermore the physical fitness category is based on the results of travel time that are matched with Cooper's method.

Data were analyzed by descriptive analysis, normality test against groups with K-S test, homogeneity test between groups with Levene Test, t-paired test, ANOVA test and Post Hoc-LSD test.

## RESULTS

### Results of Analysis of Physical Characteristics of Research Subjects

Descriptive statistical analysis of characteristics including age, height, weight, body mass index, resting pulse, exercise pulse, and 2.4 Kilometer running time. Measurement data are shown in Table-1.

**Table-1. Physical Data Characteristics of Research Subjects.**

Parameter	Mean $\pm$ SD (minutes)		
	Group-1	Group-2	Group-3
Age (years)	32.28 $\pm$ 0.70	31.14 $\pm$ 1.90	31.43 $\pm$ 1.10
Height (cm)	168.00 $\pm$ 2.20	168.00 $\pm$ 6.20	168.79 $\pm$ 3.80
Weight (kg)	68.14 $\pm$ 4.10	68.36 $\pm$ 7.00	65.71 $\pm$ 6.40
BMI kg / m <sup>2</sup>	24.13 $\pm$ 1.10	24.16 $\pm$ 1.30	23.05 $\pm$ 1.90
Resting pulse rate (beats / minutes)	78.00 $\pm$ 15.89	76.86 $\pm$ 17.73	74.86 $\pm$ 17.65
Exercise pulse (beats / minutes)	116.70 $\pm$ 2.90	145.70 $\pm$ 1.00	145.00 $\pm$ 2.24
Running Time 2.4 Km (Before)	25.86 $\pm$ 0.96	15.88 $\pm$ 0.91	15.87 $\pm$ 0.92
Time 2.4 Km (After)	15.14 $\pm$ 0.95	12.27 $\pm$ 1.21	13.65 $\pm$ 1.11

Note: SD = standard deviation, BMI = body mass index, cm = centimeter, Kg = kilograms, Kg / m<sup>2</sup> = kilograms per square meter, Km = kilometers

### Parametric Prerequisite Test Results

Before the parametric test was carried out, all normal running time data of 2.4 Kilometers both before and after treatment were tested for normality with the K-S test and homogeneity using Tesi of Homogeneity of Variances at a significance level of 0.05. Obtained all data distributed normally and homogeneously ( $p > 0.05$ ). This means that parametric tests can be used.

### Analysis of Physical Fitness Test Results

The results of data analysis of physical fitness differences measured by 2.4 kilometers of running time between before and after treatment in each group are shown as Table-2.

**Table 2: Analysis of T-Paired Test Results Running Time 2.4 Kilometers between Before and After Treatment.**

Group	Pairs variable	Mean (minutes)	t-test paired		
			Mean difference (minutes)	t	p-value
Group-1	Pretest	15.86 ± 0.95	0.72	1.578	0.166
	Posttest	15.44 ± 0.95			
Group-2	Pretest	15.88 ± 0.90	3.61	9.676	0.000
	Posttest	12.27 ± 1.21			
Group-3	Pretest	15.87 ± 0.92	2.21	6.382	0.001
	Posttest	13.65 ± 1.11			

T-paired test results showed that there was no difference in running time of 2.4 Kilometers between before and after treatment in the control group ( $p > 0.05$ ) and there was a significant difference in travel time in the 2 X 800 meter interval running group and interval running 4 x 400 meters ( $p < 0.05$ ).

Furthermore, the results of data analysis of 2.4 Kilometer run time between groups tested with the ANOVA test are shown in Table-3.

**Table 3: ANOVA Test Results Run of 2.4 Kilometers.**

Running time	Mean ± SD (minutes)			ANOVA test	
	Group-1	Group-1	Group-1	F	p-value
Pretest	15.86 ± 0.95	15.88 ± 0.90	15.87 ± 0.92	0.001	0.999
Posttest	15.14 ± 0.95	12.27 ± 1.21	13.65 ± 1.11	11.978	0.000

From the analysis of the 2.4 Kilometer run time difference between groups before treatment showed no significant difference ( $p > 0.05$ ) and there were significant differences after treatment ( $p < 0.05$ ).

To find out the mean difference in the results of the 2.4 Kilometer test run of firefighters between one treatment with another, then proceed with the Post Hoc-LSD test. The results are shown in Table-4 below.

**Table 4: LSD Test Results 2.4 Kilometer Running Test After Treatment.**

Difference pairs	Mean difference	p-value
Group-1 with Group-2	- 2.86	0.000
Group-1 with Group-3	- 1.49	0.020
Group-2 with Group-3	1.38	0.030

Table-4 shows that there was a difference in 2.4 Kilometer run time between groups after treatment in all groups of couples ( $p < 0.05$ ). This shows that the 2 X 800 meter interval training is better than the 4 X 400 meter interval training and the Control Group in improving physical fitness.

## DISCUSSION

### Physical Characteristics of Research

Based on the analysis of the results of research on physical fitness running 2.4 kilometers through interval training 2 X 800 meters, 4 X 400 meters, and the Control Group found the average age of the subjects in these three groups is almost the same, namely Group-1 =  $32.28 \pm 0, 76$  years, Group-2 =  $31.14 \pm 1.95$  years, and Group-3 =  $31.43 \pm 1.13$  years. This shows that the age range of the subject in optimal and productive physical strength for BPBD officers. When compared with previous studies on the maximum aerobic capacity assessment with a 3 km running test, the mean age of the subjects was  $19.62 \pm 2.48$  years (Sastropanoelar and Agus, 2001), which showed the average age of the subjects of this study was higher compared to According to Grandjean (2009), age affects the physical ability or muscle strength of a person, while the maximum physical ability is achieved at the age of 25-35 years and decreases with age. According to Rodahl (2010), Muscle physical strength began to decline at the age of 39 years and at the age between 50-60 years only reached 75-85%, thus the age of the subject was still in optimal physical strength for the maintenance and improvement of the physical fitness of BPBD officers.

Height and weight are directly related to body mass index, where the increase in body weight will also increase body mass index while increasing height increases the body mass index decreases. Body mass index (BMI) is a comparison of body weight (BW) with body height (BH) squared written with  $BMI = BW/BH^2$  in  $kg/m^2$  (Sandi and Parwata, 2018). The mean body mass index of study subjects in the three groups is in the ideal range. Where the mean body mass index in Group-1 =  $24.13 \pm 1.12$   $kg / m^2$ , Group-2 =  $24.16 \pm 1.26$   $kg / m^2$ , and Group-3 =  $23.05 \pm 1.13$   $kg / m^2$ . While the normal BMI interval is 18.5-24.9  $kg / m^2$  (Depkes

RI, 2005). So the research subjects are still within the range of normal BMI and are considered to have no negative impact on treatment.

The mean resting pulse in Group-1 = 78.00 beats per minute, Group-2 = 76.86 minutes, and Group-3 = 74.86 beats per minute. This shows that the mean resting pulse rate in the three groups is in the normal range which ranges from 60-90 minutes per minute (Janssen, 1993). (10) The frequency of this resting pulse is closely related to age, height and weight, especially body mass index . Previous studies found that there was a significant relationship between age and body mass index on the frequency of resting pulse (Sandi, 2013). Body mass index was a person's nutritional status. Where the body mass index increases, the nutritional status also increases, and vice versa will decrease if the body mass index decreases. Besides that, BMI is also influenced by physical activity. The research results of Ariyasa and Sandi (2017), find that there is a meaningful and simultaneous relationship between nutritional status and physical activity on nutritional status.

Astrand & Rodahl (2009) in a study of 227 male and female subjects, reported that maximum oxygen demand has a linear relationship with body weight. Maximum oxygen requirements are lower in women compared to men weighing more than 40 kg due to higher adipose tissue content. So, the higher a person's weight, the higher the maximum oxygen demand.

### **Effects of Training Models on Physical Fitness**

Based on the results of the physical fitness pretest with a 2.4 Kilometer run, the three groups were in the poor category. When compared with the results of research on Depdikbud employees in 2009 are at a lower level. Of the 341 Ministry of Education and Culture employees, 26.4% and 37.8% have less and less physical fitness, the rest have moderate to special categories (Depkes, 2005). This illustrates that in fact the average level of physical fitness of firefighters is still less and must be improved to be able to work optimally.

Analysis of physical fitness test results between pre-posttest in the Control Group there was an improvement in travel time by 0.72 with a difference of 4.5% which was statistically insignificant ( $p > 0.05$ ). Both before and after treatment were in the category of less with a mean of  $15.86 \pm 0.95$  minutes  $15.14 \pm 0.95$ . This proves that the training carried out so far, namely line-up training for 10 minutes before morning apple is not effective in increasing physical fitness. It was proven that the old training model did not have the right training principles, so that the training model could not improve the physical fitness of fire officers.

Furthermore, in the 2 x 800 meter interval training, there was an improvement in travel time of 3.61 minutes or faster by 22.7% which was statistically significant ( $p < 0.05$ ). The mean travel time at the posttest was  $12.27 \pm 1.21$  minutes which is included in the good category. Whereas in the 4 x 400 meter interval training there was an improvement in travel time of 2.21 minutes or faster by 13.9% and it was also statistically significant ( $p < 0.05$ ). The 4 X 400 meter interval training results in an increase in physical fitness from the less to moderate category with a time of  $13.65 \pm 1.11$  minutes.

The results of this study are in accordance with research Langitan (1999) about 2.4 Kilometer aerobic running training. Where after 8 weeks of training the subject experienced an accelerated travel time of 24.81% ( $p < 0.05$ ) from the less good category and in training outside the stadium accelerated the travel time of 9.35% ( $p < 0.05$ ) of the category is not moderate. Based on these results it can be stated that the interval training of 2 X 800 meters and 4 X 400 meters is an effective training model to improve physical fitness. Where the two training models have paid attention to the correct training principles that are carried out systematically, repetitively, in the right timeframe, progressively and adjusted to the individual abilities of the subject being trained (Bompa, 2009).

### **Differences in the Effects of Training Models on Physical Fitness**

Based on the analysis of the results of physical fitness tests after treatment, it was found that the mean travel time of running 2.4 kilometers in the Control Group was  $15.14 \pm 0.95$  minutes. In the 2 X 800 meter interval training the average travel time was  $12.27 \pm 1.21$  minutes while in the 4 X 400 meter interval training it was  $13.65 \pm 1.11$  minutes. Based on the ANOVA test the physical fitness test between the three groups was significant ( $p < 0.05$ ).

To find out the difference in treatment effect between one treatment with another can be seen from the results of Post Hoc LSD analysis. Comparison of travel time in Group-2 and Group-1 there is a mean difference of 2.86 minutes or an acceleration of 18.89%, which is statistically significant ( $p < 0.05$ ). Besides that there is also an increase in physical fitness from the less good category, which is caused by the 2 x 800 meters treatment given special training in the form of interval runs interspersed with the road as far as 420 meters for 8 weeks which causes an increase in body physiology. The intensity of the Group-2 training is 77.2% of the maximum pulse rate which is an effective loading. According to Nala (2015), the intensity of training that gives the most effective effect is 72-87% of the maximum pulse rate.

Comparison of average travel time between Group-3 and Group-1 was 1.49 minutes or an acceleration of 9.84%, which was also statistically significant ( $p < 0.05$ ). Thus the 4 X 400 meter interval training can improve physical fitness compared to the Control Group. In group-3 training an increase in physical fitness from the category of less to moderate which also gives an idea of the increasing physiological ability of the body. Besides that the intensity of the Group-3 training is at an intensity of 76.7% of the maximum pulse rate which is also an effective loading because it is in the positive zone training.

Between Group-2 and Group-3 was a difference in average travel time of 1.38 minutes or an acceleration of 10.11%, which was also statistically significant ( $p < 0.05$ ). Thus 2 x 800 meter interval training is better than 4 X 400 meter in increasing physical fitness. Both of these exercises have changed the level of physical fitness. The right type and dose of training can have a positive impact on agility. The increase was due to the control of neural coordination of muscle movement, with increased contractile capacity and synchronization of energy release from elastic components of muscle cells. If physical training is carried out appropriately and measurably there will be muscle hypertrophy, increased blood flow, cardiac output, stroke volume and pulse rate (Ganong, 2009; Fox, 2008).

### CONCLUSIONS AND SUGGESTIONS

From the results of the study it can be concluded that the method of running training interval 2 X 800 meters and running 4 X 400 meters for 8 weeks can improve the physical fitness of BPBD officers in Denpasar. Where the 2 X 800 meter interval training for 8 weeks is better than the 4 X 400 meter and the Control Group in improving physical fitness of Denpasar BPBD officers. Therefore it is expected to conduct 2 x 800 meter interval training in an effort to improve physical fitness.

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