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## Measurable training program to improve physical performance: literature review

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### ABSTRACT

This study aims to determine the appropriate training program and portion in order to improve the physical performance of athletes. This literature review inquiry was obtained from various PubMed and Google Scholar databases by entering keywords, namely: Sports, Yoga, Basic Physical Components, MDA and IL6. This inquiry reviewed 33 articles published in national and international online journals and have been accredited. The results literature review done on prior studies show basic physical components can be optimally improved through exercises based on the FITT formula, namely interval training, fartlek, weight training, circuit training, plyometrix, rope jump and PNF. In addition, showed that aerobic and anaerobic exercises decreased MDA levels. However, the control group experienced a very significant increase in MDA levels. High-intensity exercise was found able to trigger releasing inflammatory mediators such as TNF- $\alpha$  and IL-6. Furthermore, some literature showed that long-term yoga practice can reduce MDA levels and IL-6 levels as it as it increases antioxidant levels and anti-inflammatory levels. This literature review is expected to provide comprehensive explanation of good and measurable training programs for athletes, coaches and sports institutions. Thereby, athletes' physical performance can be optimally improved and injuries can be avoided so that athletes get sports achievements.

**Keywords:** Sport, Yoga, Physical Components, MDA Levels and IL-6 Levels

### INTRODUCTION

The peak achievement of athlete is the contribution of sports scientists who apply Sports Physiology to the latest, measurable and well-programmed training methods (Abidin, 2012). The maximum athlete's achievement can be achieved through a training process that applies Sports Physiology in determining the portion of the training and preparing the Periodization Training based on the FITT formula. A study in Papua

using the subject of 45 Persipura Junior football. This study evaluated between the group given an exercise program based on FITT and the group given conventional exercise on the basic physical components and lactic acid levels. The results showed that there was an increase in basic physical components and a very significant decrease in lactic acid levels in the group given the FITT-based exercise program compared to the conventional exercise group (Daniell, 2018). The training program based on FITT means that F: stands for the frequency of exercise per week, I: stands for the intensity or portion of exercise, T: stands for the time that shows the duration of each exercise, T stands for the type that shows the form of exercise whether it is aerobic or anaerobic. Training methods based on FITT that are carried out in a measured and well-programmed manner will be able to improve athlete's performance. (Anggriawan, 2015; Bafirman, 2013).

Other various factors that affect the athletes' physical condition include high levels of free radicals (MDA levels) in the blood. Free radicals (MDA levels) are very reactive molecules and if they are excessive contained in the body, they will cause oxidative stress that can damage body tissues. Oxidative stress is a condition where there is an imbalance between pro-oxidant and antioxidant. When the amount of antioxidants needed by the body during oxidative stress is insufficient, these free radicals can damage cell membranes, proteins, and DNA (Apriyanto, 2011; Sylviana et al., 2017).

The results showed that strenuous exercise carried out by athletes would produce free radicals (MDA levels) that are relatively high. Research conducted in Birmingham by ultra-marathon athletes under the age of 30 proved that running 142 miles a week can cause oxidative stress that can last up to a month (James, 2011). Research conducted in Turkey on trained and untrained subjects after being given aerobic exercise for 30 minutes aimed at determining the level of MDA levels, the results obtained showed a significantly higher percentage increase in MDA levels in the untrained group (Algul et al., 2018) . High-intensity exercise

that is done repeatedly for a long time will produce free radicals that are enough to damage cell membranes, DNA, proteins, fats and tissues. (Algul et al., 2018; James, 2011).

Another factor that affects the athletes' physical condition caused by strenuous training is an increase in IL-6 levels in the blood. Interleukin-6 (IL-6) is a pro-inflammatory cytokine that mediates the inflammatory process, immune response and hematopoiesis (Putu, 2014). Excessive IL-6 levels in the blood can also stimulate the cortisol, catecholamines, interferon alpha, and plasma IL-1 levels. The increase in the cortisol will affect the athletes' psychological condition, namely increasing feelings of stress and ultimately affecting the athletes' physical condition (Shodiq, 2016).

Various factors that have been described previously play a role in reducing the physical condition of athletes. Besides, there are also other factors, namely the ability of the basic physical components that have not been maximized: namely the muscle strength, muscle endurance, flexibility, muscle explosive power and general endurance (Daniel, 2018; Slamet, 2011).

Athletes who do high intensity training will affect their psychological condition and physical condition. Recently, to overcome this situation, athletes are often given yoga. Yoga is a therapy that combines breathing techniques, relaxation and meditation as well as stretching exercises. The benefits of yoga in general increase muscle strength and flexibility, train balance, reduce pain, practice breathing, smooth organ function, invite inner peace and increase concentration and intelligence (Pujiastuti, 2019).

The findings of this study are expected to provide information and understanding of the role of exercise programs based on FITT on basic physical components, MDA levels and IL-6 levels in athletes. By providing a good and measurable exercise program, it can improve the optimal physical performance of athletes and avoid injury so that athletes get sports achievements.

## METHOD

Literature reviewed in this study were retrieved from PubMed (a journal search engine platform focusing on natural and biomedical sciences) and Google Scholar using keywords; Sports , Yoga Exercises, Basic Physical Components for Athletes, MDA Levels and IL6 Levels.

All papers included in this study were research-based articles published in national and international online journals and have been accredited or indexed by Sinta Research Dikti and Scopus. Those papers were original research-based journals with high relevance to health and exercise topics published between 2010 – 2020 with complete abstracts. The papers used in this literature review have met the feasibility criteria based on PICO criteria (Population, Intervention, Comparison, Outcome) as described in Table 1 (Methley et al., 2015).

**Table 1.** Search strategy and inclusion/exclusion criteria based on PICO.

PICO	Inclusion Criteria	Exclusion Criteria
Population	Healthy respondents between 17-40 years old of age	Experiencing injuries
Intervention	Aerobic and anaerobic exercises	
Comparison	Control (not given any intervention)	
Outcome	Basic physical components: Cardiovascular endurance, muscular strength, muscular explosive strength, and flexibility.  MDA and IL-6 levels	Antioxidant level  Anti-inflammatory cytokine

The literature review stage of this literature review is collecting research articles that match the inclusion criteria and then collecting the results or research findings which are then analyzed and compiled into a literature review by following the rules of writing preferred reporting items

for systematic reviews and meta analyzes (PRISMA) 2015 (Hamseer et al., 2015).

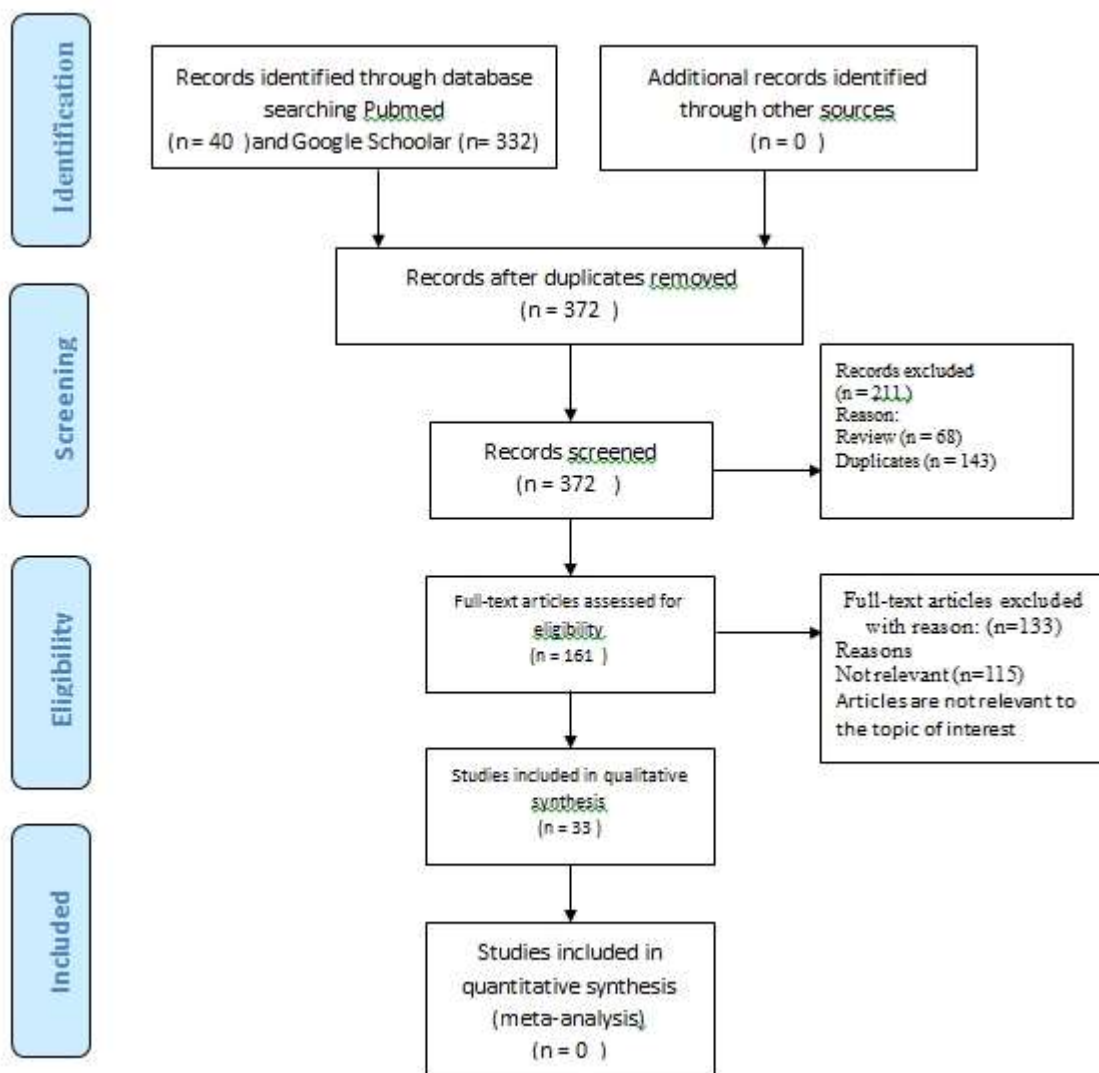


Figure 1. Prisma Diagram Flow

## RESULT

The literature review inquiry was aimed to explain the effect of training based on the FITT formula and yoga on the ability of athletes' basic physical components, MDA levels and IL-6 levels.

### Effect of training based on the FITT on basic physical components

Based on the results of reviewing five articles that evaluated the effects of training based on FITT can increase cardiovascular endurance. athletes using the High Intensity Interval Training (HIIT) method, the

Fartlek training method and the Circuit Training method can increase cardiovascular endurance.

Based on the results of reviewing three articles that evaluated the effects of training based on FITT can increase muscle strength using the weight training method. This increase occurs after 4-8 weeks of exercise using several training methods and with an intensity of 50% -80% maximum repetitions or 8-12 RM, performed 2-3 per week, carried out 3 sets of each training session. In addition, the form of training is classified as anaerobic.

Based on the results of reviewing three articles that evaluated the effects of training based on FITT can increase Muscle explosive power using plyometrix. increase occurs after conducting the training for 4 until 8 weeks using several training methods and with an intensity of 50% -80% maximum repetitions or 12-15 RM

Based on the results of reviewing three articles that evaluated the effects of training based on FITT can increase muscle endurance. athletes using Rope Jump exercises or skipping interval training methods can increase muscle endurance.

Based on the results of reviewing three articles that evaluated the effects of training based on FITT can increase flexibility. This increase occurred after 4 until 8 weeks of training using the Proprioceptive Neuromuscular Facilitation (PNF) training method

#### **Effect of training based on the FITT on MDA**

Based on the results of reviewing nine articles that evaluated the effects of training based on FITT can decrease in MDA levels in their blood. This increase occurred after 8 until 12 weeks of training after doing Yoga and training Aerobic and Anaerobic.

#### **Effect of training based on the FITT on IL-6**

Based on the results of reviewing nine articles that evaluated the effects of training based on FITT can decrease in IL-6 levels in their blood. This increase occurred after 8 until 12 weeks of training after doing Yoga. The results of the literature review can be seen in table 2.

**Table 2.** Performance Improvement

Researchers (Year)	Journal Source	Research Method	Results
Nicholas, <i>et al.</i> , 2017	Journal of Human Performance in Extreme Environments (International)	Male teenagers aged 15 to 17 years. 3 Groups: Control group, low intensity group and moderate intensity group	Serum IL-6 ↓ VO2Max ↑
Maya, <i>et al.</i> 2013	Jurnal Keolahragaan (Sinta 2)	Male aged 16 to 21 years, Cooper test 2 Groups: Fartlek group and Continuous tempo Group	VO2Max ↑
Asih, <i>et al.</i> 2015	Jurnal Ilmiah Kesehatan Olahraga (Sinta 3)	Males aged 18 to 22 years, wall sit and jump squat 2 Groups: Jump rope group and interval training method group	Leg muscle endurance ↑
Wahyu, <i>et al.</i> 2019	Jurnal Pendidikan Jasmani dan Olahraga (Sinta 2)	Males aged 18 to 22 years, Balke test circuit training group 8 weeks	VO2Max ↑
Elsa, <i>et al.</i> 2014	Jurnal Sainstek (Sinta 4)	Male aged 15 to 17 years. group : application of submaximal training (20 meter shuttle test)	Serum IL-6 ↑
Sermin, <i>et al.</i> 2018	Eastern Journal OF Medicine	Males aged 21 to 23 years, 30-minute aerobic bike 2 Groups: Trained Group ( 3 times a week training), Untrained Group (no more than 1 hour per week training)	Serum MDA ↓
Olav, <i>et al.</i> 2016	Plos One	Trained women, Strength, jumping and running test. 2 Groups: The application of strength & endurance training group and the application strength training group.	Strenght (leg) ↑ Running Performance ↑ VO2Max ↑
Ingole, <i>et al.</i> 2015	MedPulse – International Medical Journal	30 subjects aged 20 to 30 years application of vipassana yoga	Serum MDA ↓
Fabio, <i>et al.</i> 2017	Frontiers in	Trained males with an average age of 26 years.	Serum IL-6↓

	Physiology	Control group (without intervention), HIIT group (1x1-min at 100% intensity) and SST group (continuous intensity 70%)	Serum IL-10 ↓ Serum TNF-α ↓ NEFA ↓ Glucose ↓
<a href="#">Felix, et al. 2016</a>	Hindawi	9 healthy male students aged 18 to 30 years.2 Groups: Endurance training group (45min of ergometer cycling at a moderate intensity, which was calculated at 62.5% of HRM) HIIT group (6 sets of 30 s of all-out supramaximal intensity cycling)	Serum C-reactive Protein ↓ Serum IL-1β ↑ Serum IL-6 ↑ Serum IL-10 ↓ Serum MCP-1 ↓ Serum IGF-1 ↑
<a href="#">Reihmande, et al. 2012</a>	Journal Eur Appl Physiol	Healthy male long distance runners aged 22 to 30 years. 2 Groups: Half Marathon Group, Marathon Group	Serum IL-6 ↑ Serum TNF-α ↑
<a href="#">Aristoteles, et al. 2016</a>	Journal Kedokteran UM-Surabaya	6-8 weeks old male wistar rat, jogging treadmill 7 groups: P1 control, P2 (1 time aerobic training) P3 (3 times a week aerobic training) P4 (7 consecutive days of aerobic training) P5 (1 time anaerobic training) P6 (3 times a week anaerobic training) P7 (7 consecutive days of anaerobic training)	Serum MDA ↑
<a href="#">Park, et al. 2016</a>	Journal of Exercise Rehabilitation	Healthy males aged 18 to 30 years, treadmill test. 3 groups: the Untrained group, aerobically trained athletes group, anaerobically trained athletes group.	Serum MDA ↑ protein carbonyl ↑ Antioxidant capacity ↓
<a href="#">Rifqi, et al. 2020</a>	Jurnal Keolahragaan (Sinta 2)	Healthy males aged 18 to 25 years, Multi Stage Fitness Test 2 Groups: HIIT Group and Fartlek Group	VO2Max ↑
<a href="#">Nobuyasu, et al. 2018</a>	Sports	Males with an average age of 20 years, the	VO2Max ↑



		egrometer bicycle test. 2 Groups: Low cadance group High cadance group	
<a href="#">Akmal et al. 2014</a>	Jurnal Keolahragaan (Sinta 2)	Males who are active in sports aged 16 to 17 years, Multi Stage Fitness Test, scales and meters. 2 Groups: Circuit training group and fartlek trainig group	VO2Max ↑
<a href="#">Eneko, et al. 2019</a>	Plos One	Healthy male who are actively involved in weight training aged 18 to 35 years. 2 groups: control (1 time per week weight training), experimental (6 exercise movements of 3 sets performed 4 times per week	<i>Muscle thickness :</i> <i>Vastus lateralis</i> ↑ <i>Rectus femoris</i> ↑ <i>Vastus intermedius</i> ↑ <i>Strength :</i> <i>Back Squat</i> <i>Bench Press</i> <i>Motivation</i> ↑
<a href="#">Wahyu, et al. 2017</a>	Jurnal Ilmiah Mandala Education (Sinta 4)	Healthy male aged 16 to 18 years, leg dynamometer and jump MD test. 3 Groups: Control group, plyometric training group, weight training group	Leg muscle strength ↑ Leg muscle explosive power ↑
<a href="#">Devi, et al. 2018</a>	Jurnal Sportif ( Sinta 2)	Healthy male aged 16 to 18 years, leg dynamometer and jump MD test. 4 groups: control group, group 2 jump to box) group 3 (depth jump training) group 4 (single leg depth jump training)	Leg muscle strength ↑ Leg muscle explosive power ↑
<a href="#">Benzidane, et al. 2020</a>	Sciendo	Healthy male aged 20 to 22 years, High Jump test. 2 groups :control group and experiment group (plyometric exercises )	<i>Muscle power :</i> <i>Vertical jump</i> ↑ <i>High jump</i> ↑
<a href="#">Ishak, et al. 2015</a>	Jurnal Terapan Ilmu Keolahragaan (sinta 3)	Healthy Male aged 18 to 22 years. 2 groups: group 1 (half squat jump training) group 2 (skipping training)	Leg muscle power ↑ Leg muscle endurance ↑

<a href="#">Jason, et al. 2014</a>	Journal of Strength and Conditioning Research	Healthy males and females aged 19 to 25 years, sit and reach test. 2 groups: group 1 (PNF) group 2 (static stretch)	HIP ROM ↑ Flexibility ↑
<a href="#">WootaeK. 2019</a>	Journal of Physical Therapy Science	Healthy males aged 16 to 18 years, side split test 2 groups: group 1 (given PNF) group 2 (ballistic stretching)	Leg muscle flexibility ↑
<a href="#">Negin, et al. 2018</a>	Journal of Clinical Physiotherapy Research	Male aged 10 to 15 years, Active knee extension test and Passive straight leg raise. 4 groups: group 1 (PNF), group 2 (static stretching) group 3 (kinesio tape) group 4 (non-tape)	<i>Hamstring Flexibility :</i> <i>Active knee extension test</i> ↑ <i>Passive straight leg raise</i> ↑
<a href="#">Yeong, et al. 2015</a>	J Physiology Ada	Females who had an average age of 20 years. 2 groups: group 1 (control) group 2 (Hatha yoga)	Serum MDA ↓ Serum SOD ↑
<a href="#">Lim, et al. 2015</a>	The Journal Of Alternative And Complementary Medicine	Healthy males and females aged 19 to 25 years. 2 groups: group 1 (control) group 2 (regular yoga exercises)	Serum MDA ↓ Antioxidant : Serum SOD ↑
<a href="#">Mahalakhmamma, et al. 2016</a>	J Cont Med A Dent	Healthy adult male. 2 groups: group 1 (control) group 2 (yoga exercise)	Serum MDA ↓ Serum urid acid ↑
<a href="#">Rajak, et al. 2016</a>	International Journal of Current Research	Healthy Male aged 20 to 25 years. 2 groups: group 1 (control) group 2 (Sahaja yoga)	Serum MDA ↓
<a href="#">Samrta et al. 2019</a>	East African Scholars Journal of Medical Sciences	Healthy men and women aged 20 to 30 years, blood sampling. 2 groups: group 1 (control) group 2 (yoga exercise)	Serum MDA ↓ Serum thiol levels ↑
<a href="#">Vandana et al. 2017</a>	International Journal of Health Sciences & Research	Males and females over the age of 20 to 30 years with knee injuries. 2 groups: group 1 (undergoing conventional treatment	Serum IL-6 ↓ Serum IL-10 ↓

		and added with yoga exercise) group 2 undergoing conventional treatment	
<a href="#">Sanjay et al.2017</a>	Journal of Education and Health Promotion	Males and Females aged 20 to 30 years. 2 groups: group 1 (control) group 2 (given yoga)	IL-6 ↓ TNF-α ↓
<a href="#">Nicole et al. 2019</a>	Behavioral Medicine	Males and females over the age of 18 who have a history of depression.. 2 groups: group 1 (control) group 2 (yoga exercise)	Serum IL-6 ↓ TNF-α ↑
<a href="#">Neng, et al. 2016</a>	Hidawi BioMed Research International	Healthy female aged 18 to 25 years. 2 groups: group 1 (control) group 2 (hatha yoga)	Serum IL-6 ↓ IL-1 ↓ TNF-α ↓

## DISCUSSION

### Effect of Training Based on FITT on Cardiovascular Endurance

Literature review inquiry from two articles with athletes using the High Intensity Interval Training (HIIT) method, for research subjects, which aims to increase cardiovascular endurance (VO2Max). The results show that there was a very significant increase in cardiovascular endurance. In addition, the resting heart rate and basal pulse were relatively low and blood pressure was within normal limits. A relatively low decrease in trained people's heart rate shows the efficient heart's work. Therefore, to determine their degree of fitness, people often use the resting heart rate or basal pulse ([Festiawan et al., 2020](#); [Tomabechi et al., 2018](#)).

Literature review inquiry of the two other articles with athletes using the Fartlek training method, as their research subjects, which aims to increase cardiovascular endurance. The results showed a very significant increase in cardiovascular endurance. Fartlek is a training method that regulates the desired walking speed based on the exercise intensity of 75%-85% of the maximum heart rate. Fartlek training are often carried out in open fields. ([Almy et al., 2014](#); [Maya et al., 2013](#)).

Literature review inquiry were obtained from two other articles with athletes using the Circuit Training method, for research subjects, which aims to increase cardiovascular endurance. The results showed a very significant increase in cardiovascular endurance. ([Almy et al., 2014](#); [Ramadan et al., 2019](#)).

Cardiovascular endurance has an important role for athletes to have good endurance, since athletes with good endurance can carry out training or competitions for a relatively long time. This is because these athletes do not experience fatigue quickly ([Festiawan et al., 2020](#)).

### **Effect of Training Based on FITT on Muscle Strength**

Literature review inquiry were obtained from three articles with athletes using the weight training method, for research subjects, which aims to increase muscle strength. The results showed a very significant increase in muscle strength ([Baz-Valle et al., 2019](#); [Hananingsih, 2017](#); [Vikmoen et al., 2016](#)). Weight training is the most common type of strength training, whose function is to increase muscle strength and increase skeletal muscle mass. With well-measured and programmed muscle strength training, it will increase muscle strength due to: an increase in the number of muscle fibers, an increase in the size of muscle fibers, an increase in the number of mitochondria and the size of the mitochondria that play a role in supplying energy during muscle contraction ([Vikmoen et al., 2016](#)).

Muscle strength has an important role for athletes' performance to achieve maximum performance because athletes who have good muscle strength generally have good physical conditions. Athletes who have good muscle strength are rarely injured during training or competition. ([Hananingsih, 2017](#)).

### **Effect of Training Based on FITT on Muscle Explosive Power**

Based on the results of reviewing three articles that evaluated the effects of training based on FITT can increase muscle explosive power.. From the literature review inquiry with research subjects using the Plyometrix training method in athletes, it was found that there was a very

significant increase in muscle explosive power (Devi et al., 2018; Hananingsih, 2017; Houcine et al., 2020).

Plyometrix trainings are very often used to increase muscle explosive power. Plyometric training is a training method by using fast and explosive jumping movements that are repeated sequentially. Physiologically, explosive movements cause muscles to quickly shift between eccentric and concentric contractions (Houcine et al., 2020).

Muscle explosive power has an important role for athletes' performance, for example for volleyball athletes, soccer athletes, badminton athletes and others. Muscle explosive power is an important ability in sports activities, because it will determine how hard the athlete can hit, kick, jump, run and so on (Hananingsih, 2017).

### **Effect of Training Based on FITT on Muscle Endurance**

Based on the results of reviewing three articles that evaluated the effects of training based on FITT can increase muscle endurance. This increase occurred after 3 until 6 weeks of training using the interval training method. From the literature review inquiry on athletes using Rope Jump exercises or skipping interval training methods, as the subjects, it was found that there was a very significant increase in muscle endurance (Ishak, 2015; Winarni, 2015).

Muscle endurance is the ability of muscles to perform continuous contractions while holding a sub-maximal load for a certain period of time (Ishak, 2015). Muscle endurance has an important role for athletes, especially in branches that require muscle endurance, for example: long-distance running athletes, cycling athletes and others. (Winarni, 2015).

### **Effect of Training Based on FITT on Flexibility**

Based on the results of reviewing three articles that evaluated the effects of training based on FITT on flexibility. The results of the review show that training based on the FITT formula can increase flexibility. This increase occurred after 4 until 8 weeks of training using the *Proprioceptive Neuromuscular Facilitation* (PNF) training method. From the literature review inquiry with research subjects using the PNF training method in

athletes, it was found that there was a very significant increase in flexibility ([Wootaeck. 2019](#); [Arjang et al., 2018](#); [Jason et al., 2014](#)).

PNF is a form of training using assisted stretching when the muscles contract and relax. This training will have an effect on better flexibility in the athlete's joints ([Wootaeck. 2019](#)). Flexibility is a physical component that has an important role for athletes. Athletes who have good flexibility will be easier to move well because they have good range of motion. In addition, athletes who have good flexibility have a relatively lower risk of injury. ([Wootaeck. 2019](#)).

### **Effect of Training Based on FITT on MDA Levels**

Based on the results of reviewing three articles that evaluated the effects of training based on FITT on MDA levels in trained athletes' blood. From the literature review inquiry, we compared the trained group that was treated with aerobic training and the untrained group that was treated with aerobic training (control).. The results showed that the MDA levels in the trained group after being given treatment were lower than the control group (which was not treated ([Algul et al., 2018](#); [Aristoteles, 2016](#)).

Literature reviews inquiry from other articles, namely the group that was treated with aerobic and the group that was treated with anaerobic training and the control group. The results showed that there was no significant difference in MDA levels within the blood between the group that was given aerobic training and the group that was given anaerobic training. However , when compared to the control group, it was found that MDA levels in the blood were greater in the control group ([Park et al., 2016](#)).

Based on the results of the literature review from 6 articles that analyzed the level of MDA levels in the blood in healthy people after doing yoga, the healthy people who were given yoga for 12 weeks showed a very significant decrease in MDA levels in their blood ([Canda et al., 2016](#); [Ingole et al., 2015](#); [Gupta et al., 2015](#)).

The result of literature reviews from other articles on healthy people who were treated with yoga for 8-12 weeks showed a very significant

decrease in MDA levels in the blood. In this study, it was also found in people who were given Yoga training treatment for 8-12 weeks, there was an increase in antioxidant levels such as SOD, GSH & CAT (Lim et al., 2015; MinSung et al., 2015; Vandavasi et al., 2015).

MDA is the main form of aldehyde produced from lipid prooxidation networks and is commonly used as a biomarker of oxidative stress (Daniel, 2018). Physiologically, oxidative stress occurs during strenuous physical activity due to an imbalance between oxidation and reduction. Comparison of the composition of oxidants with antioxidants determines whether there is a negative impact on cells or tissues (Sinaga, 2016).

Oxidative stress often occurs in a state of severe hypoxia during physical activity. In some research, training intervention was able to reduce signal transduction indicators produced from the effects of free radicals and stimulate antioxidants. Oxidative stress due to strenuous activity in tissues has been shown to damage cell tissues, causing inflammation in muscle tissue, DNA damage and protein changes (Algul et al., 2018).

In order to avoid oxidative stress from oxygen, it must be completely reduced to H<sub>2</sub>O by accepting four electrons assisted by an enzyme called Superoxide Dismutase (SOD). This SOD enzyme protects body cells and prevents the inflammatory process caused by free radicals in muscle tissue. Thus the sensitivity of muscles to free radical damage can be anticipated.

### **Effect of Training Based on FITT on IL-6 Levels**

Based on the results of reviewing five articles that evaluated the effects of training based on FITT on IL-6 levels in athletes after doing submaximal training. A study analyzing 22 Half Marathon (HM) runners and 18 Full Marathon (FM) runners obtained the same results, namely there was a significant increase in post-exercise IL-6 levels (Reihmane et al., 2012). Another study conducted to analyze student athletes who were given submaximal training found a significant increase in the concentration of IL-6 levels (Yuniarti, 2014).



Literature reviews from other articles that conducted research on 10 athletes who did moderate-intensity exercise, ran 5 KM with a heart capacity of 70% and the other group, contained 10 athletes, did high-intensity exercise running at intervals with a heart capacity of 100% found that both groups shows significant increase in post-exercise IL-6 levels (Kaspar et al., 2016; Lira et al., 2017).

Based on the results of reviewing four articles that evaluated the effects of training based on FITT. In the group given Yoga for 8 weeks showed a very significant decrease in IL-6 levels (Chen et al., 2016; Shete et al., 2017).

Literature reviews from other articles that conducted research on athletes with knee injuries, presents that after being given yoga exercises for 6 months the athletes showed a significant decrease in IL-6 and IL-1a levels, but there was a significant increase in anti-inflammatory cytokines of IL-10 levels (Awasthi et al., 2017)

Literature reviews from other articles that conducted research on humans who experienced depression after being given yoga for 10 weeks showed a result that there was a significant decrease in the concentration of IL-6 levels (Nugent et al., 2019).

Interleukin-6 (IL-6) is a pro-inflammatory cytokine that mediates the inflammatory process, immune response and hematopoiesis. Scientists have proven that IL-6 levels are closely related to skeletal muscle activity so that they are included in the myokine group (Yuniarti, 2014). Several studies assess this situation, in submaximal training, it can trigger an inflammatory process in the endothelial cells of blood vessels as a result of Sheat Stress. It causes the release of inflammatory mediators in the form of cytokines, one of which is IL-6 levels (Jin et al., 2018).

From the literature review above, it was shown that there was a significant decrease in IL-6 levels after being given yoga training. Yoga training has many benefits for health because it has been shown to reduce proinflammatory cytokine responses. Besides, yoga can increase anti-inflammatory cytokines (Awasthi et al., 2017).



## CONCLUSION

It can be concluded from the results of this literature review that athletes' basic physical components can be optimally improved through exercises based on the FITT formula, namely interval training, fartlek, weight training, circuit training, plyometrix, rope jump and PNF. This study also showed that aerobic and anaerobic exercises decreased MDA levels in the blood. However, the control group experienced a very significant increase in MDA levels in the blood. This problem might occur due to excessive oxidative stress during hypoxia condition or when oxygen supply was lacking during physical activity which then caused damages to cell tissue, muscle, DNA and protein changes. High-intensity exercise was found able to trigger inflammatory process in endothelial cells, releasing inflammatory mediators such as TNF- and IL-6. Furthermore, some literature showed that long-term yoga practice can reduce MDA levels and IL-6 levels in the blood as it increases antioxidant levels in the form of SOD and GSH and increases the levels of an anti-inflammatory cytokine namely IL-10. Therefore, performing measurable exercise programs based on the FIIT formula can improve basic physical components, reduce MDA levels and IL-6 levels in the blood for better performance of athletes.

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