The Effect Of Giving Red Dragon Fruit (*Hylocereus polyrhizus*) Extract On Spermatozo Motility In White Rats (*Rattus norvegicus*) Wistar Line With High Fat Induction

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A B S T R A C T

Hyperlipidemia is a condition when high level of blood lipids and causes morphological changes in spermatozoa. Red dragon fruit (*Hylocereus Polyrhizus*) is one of the plants as a source of antioxidants and has unsaturated fat content that is needed in the spermatozoa maturation process. The aims of this study is to determine the benefits of red dragon fruit extract on the motility of white rat spermatozoa (*Rattus norvegicus*) induced by high-fat diet. The study is design by true experimental research and research only testing group design. This research conducted in the Pharmacology and Therapy Laboratory, Padjajaran University Education Hospital, in January 2020 using white rats, male ± 8 weeks wistar strains weighing ± 200-250. The study sample was divided into several groups such group I as a control, group II as a negative control, group III as positive group with simvastatin dose 0.72 mg / day, group IV as research group 1 using red dragon fruit extract dose of 60 mg / 200 grBB / day for 52 days, and group V as group 2 therapy using dragon fruit extract dose of 60 mg / 200grBB / day for 104 days. The results showed that the mean percentage of motility of rat spermatozoa increased in the relief group with the supplement of red dragon fruit extract by dosing of 60 mg / 200 grBB / day for 104 days, or 51.2%. This study conclude that red dragon fruit has a superior effectivity better than simvastatin in increasing the motility of spermatozoa.

1. Introduction

Hyperlipidemia is a condition of increasing blood lipid levels characterized by increased levels of total cholesterol, Low Density Lipoprotein (LDL), and triglycerides in the blood that exceed normal limits. In a study conducted by Harini (2009) it was reported that the normal condition of total cholesterol is amounting to 10 - 54 mg / dl. Then in a study conducted by Nugroho (2013) it was reported that the normal condition of triglycerides in rats was 27.89-29.44 mg / dl, and a study conducted by Herwiyariransanta (2010) reported that the normal threshold for LDL in mice was 7 - 27.2 mg / dl. Lipids are compounds that have an important role in cell structure and function. The main plasma lipids consist of cholesterol, triglycerides, phospholipids and free fatty acids. These hydrophobic lipids in the circulation are in the form of a lipid - protein or lipoprotein complex. Plasma lipoproteins consist of: Kilomicrons, Very Low Density Lipoprotein (VLDL), LDL, and High Density Lipoprotein (HDL). The composition and function of each lipoprotein are different. In previous studies, a high-fat diet in mice can lead to hypercholesterolemia, which plays an important role in increasing the production of free radicals and the mismatch of lipid peroxide development at the tissue
level, which will cause changes in spermatozoa morphology. Feeding the mice a diet supplemented with fat led to an increase in cholesterol levels and a decrease in some gonadal cells. This will affect the motility of the spermatozoa so that the decreased motility of the spermatozoa will affect the fertilization process. In addition, a high-fat diet can cause impaired function of the pituitary-pituitary-gonadal pathway and a disruption of the spermatogenesis process and a decrease in HDL and an increase in total cholesterol will cause male erectile dysfunction.

Free radicals in the body can come from endogenous or exogenous. Endogenously, free radicals can come from eating traceable lipid sources. form lipid peroxidation in the body. In addition, endogenous radicals, free radicals come from pollutants, cigarette smoke, radiation and others.

Consuming high cholesterol and fatty foods can lead to obesity. Men with obesity tend to have a lower number of spermatozoa when compared to men of normal weight. Obese men have less good motility of spermatozoa than men who are not obese. This is related to changes in levels of testosterone and other reproductive hormones that occur in obese men.

The increase in cholesterol levels plays a role in producing free radicals which are accelerated by oxidative stress reactions. Oxidative stress reactions (ROS) can cause damage to biological macromolecules including oxidation of low density lipoproteins (oxidized-LDL), triglycerides, endothelial dysfunction and an increase in inflammatory responses that originate from oxidation of unsaturated fatty acids in the lipid layer of cell membranes. This reaction initiates a chain of lipid oxidation which will cause damage to cell membrane.

If there are excess free radical compounds in the body, the body will not be able to handle it so the body needs a supply of antioxidants from outside to neutralize the radicals that are formed. To prevent the bad effects of free radicals, antioxidants are needed. Antioxidants play an important role in protecting spermatozoa against ROS, this may help repair spermatozoa abnormalities due to free radicals so that it will increase the quality and quantity of spermatozoa.

Antioxidants are compounds that can inhibit the fat oxidation process. Antioxidants stabilize free radicals by complementing the lack of electrons that free radicals have and will inhibit the chain reaction from forming free radicals. If the formation of free radicals is inhibited, the motility of spermatozoa in obese men will improve.

One study shows that the nutritional components of fruits and vegetables can lower cholesterol levels. Currently there are more and more studies on fruits that have a high antioxidant content, one of which is red dragon fruit.

Red dragon fruit (Hylocereus Polyrhizus) is a plant that is used as a source of antioxidants. Red dragon fruit is believed to reduce cholesterol levels, balance blood sugar levels, prevent colon cancer, and increase fertility. In addition, red dragon fruit seeds also contain unsaturated fats which are needed in the maturation process of spermatozoa.

From the research results, red dragon fruit can help maintain the survival of spermatozoa and also plays an important role as a fertility agent because it contains antioxidants and anti-proliferative properties.

Along with the times, dragon fruit is not only used as decoration and food but also used as a fruit which is one of the natural herbal medicines. Dragon fruit contains vitamin E which is high enough to increase fertility. Based on the content of substances contained in red dragon fruit, researchers are interested in conducting this research.

2. Research Methods

Research design

The research conducted was a true experimental research design with a test only control group design. The purpose of data collection is to determine the effect of the treatment variable (independent variable) on the impact variable (dependent variable).

Population and sample
The study population was male white rats. The samples of this research were white rats \textit{(Rattus Norvegicus)}, Wistar strain, males weighing ± 200-250 and aged ± 8 weeks.

**Research variables**

The independent variable in this study was the red dragon fruit variable and the dependent variable in this study was sperm motility.

**Operational Definition of Research Variables**

The operational definition can be described as follows:

Red dragon fruit. Extracts obtained by maceration method extracted the active compound of red dragon fruit and used 96\% ethanol as solvent.

Sperm motility. Spermatozoa motility is the active movement of spermatozoa which is observed microscopically.

**Research Instruments**

**Material**

The experimental animals were white mice that met the inclusion criteria, Red Dragon Fruit Extract \textit{(Hylocereus polyrhizus)}, Na-CMC \textit{(Carboxymethyl Cellulose)}, 0.9\% NaCl, Simvastatin, Cholesterol reagent kit, Bravo 512 standard feed, quail eggs, Gloves, Slides, Aquadest.

**Tool**

Experimental animal cages along with drinking bottles and wire nets as a place to put feed, measuring cups, test tubes, binocular microscopes, 1 set of sterile surgical instruments, scapples, micropipettes, stomach sonde.

**Research procedure**

**Experimental Animal Acclimatization**

Acclimatization in animals will be carried out for 7 days to adapt the experimental animals to the experimental conditions and are given standard feed and adequate drinking (Lailani 2013, p. 147).

Adaptation is carried out in a cage that has a rectangular shape of 960 cm$^2$ for every 1 mouse weighing 150-250 gr, with a light intensity between 1-25 lux, with a silus setting of 12 hours with light and 12 hours without light, humidity 40-60\% and temperatures in the range 20-26 °C.

**Determination of the Dosage**

**Dragon Fruit Extra Dose**

The extra dose of red dragon fruit was determined by the researcher by conducting preliminary research \textit{(pre-experimental)} on 3 variations of the dose, namely 30 mg / 200grBB / day, 60 mg / 200grBB / day, and 120 mg / 200grBB / day. Research conducted by Indriasari in 2012, stated that the effective dose of red dragon fruit extract in improving lipid profiles was 60 mg / 200grBB / day. So, the results of preliminary research \textit{(pre-experimental)}, show that the effective dose of red dragon fruit extract is 60 mg / 200grBB / day.

**Simvastatin dosage**

The hypovolemic drug used in this study as a comparison group was using simvastatin \textit{(HMG CoA Reductase Inhibitor class)}. Simvastatin has a much stronger effect on lowering cholesterol levels than other hypolipidemic drugs in the HMG CoA Reductase Inhibitor class. The maximum therapeutic dose of simvastatin administration in humans is 40 mg / day (Katzung 2012, p. 627). The simvastatin dose calculation used in this study was 40 mg / day x 0.018 = 0.72 mg / day because the dose conversion constant from humans (70kg) to mice (200 gr) was 0.018.

**Standard Feed**

The selection of Bravo-512 feed is based on the ease of access to obtain it, and the similarity in the percentage of nutrient content with other standard diets in experimental rat studies. The standard Bravo-512 feed will be provided \textit{ad libitum}. 

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High Fat Feed Making

Feed making is done by mixing 50 grams of egg yolk (5%) and 100 grams of goat fat (10%) in 1000 grams of standard feed. Previously, the goat fat was heated until it melted, then mixed with the beaten egg yolk. This mixture is then put into standard feed, chilled feed, and high fat feed is ready to be served for male rats as a treatment to increase male rat cholesterol levels. 20 g / day 18 feed will be given.

Preparation Preparation

Preparation of CMC (Carboxymethyl Cellulose) Solution

The solution is made by:

Weigh 5 grams of CMC first, then put 100 ml of CMC in hot water (aquadest) little by little and stir until homogeneous. Once homogeneous, cool the solution to room temperature and the CMC solution can be used to dissolve dragon fruit extract and simvastatin.

Making Dragon Fruit Extract (Hylocereus sp.)

Red dragon fruit extract was obtained from the Research Institute for Spices and Medicines (Balittro), Bogor, West Java. Red dragon fruit extract was prepared using the maceration method with 96% ethanol as a solvent.

Fresh dragon fruit is peeled and then crushed using a blender, added with 96% ethanol solvent, put in the container until everything is submerged, closed and left for 2 x 3 days, protected from light while stirring, filtered so that it can be macerated. The pulp was macerated with 96% ethanol using the same procedure, maceration was carried out until a clear macerate was obtained. All ethanol macerates were combined and evaporated using a rotary vacuum evaporator at a temperature of ± 50˚ C until a thick ethanol extract was obtained.

Making dragon fruit extract preparations is carried out every time you will brush by calibrating the electric scale first, then placing the measuring cup on the scale, first measuring the weight of the measuring cup.

Then enter the red dragon fruit extract, namely: Red dragon fruit extract = 60 mg x 6 rats = 360 mg = 0.36 gr. Then mix with 2 ml of CMC / mouse solution (2 ml x 6 tail = 12 ml of CMC solution) and stir until homogeneous.

After the red dragon fruit extract preparation is ready, then prepare a 5 ml stomach sonde and take 2 ml of the solution for each mouse and give it to the mice with certainty and with care.

Preparation of Simvastatin

Making preparations is done every time you want to calibrate the electric scale first, then place the measuring cup on the scale, first measure the weight of the measuring cup. Then enter simvastatin according to the required dose, namely:

Simvastatin dose: 0.72 mg x 6 tails = 4.32 mg = 0.00432 gr, then mix with 2 ml of CMC / rat solution (2 ml x 6 tails = 12 ml of CMC solution) and stir until homogeneous.

After the simvastatin preparation is ready, take 2 ml of simvastatin solution using a gastric swab to be given to the treatment group I rats for 52 days at 10 am.

Treatment Intervention in Experimental Animals

After the rats were acclimated for 7 days, all rats were divided into 5 groups, where one group contains 6 rats using random sampling with the following treatment:

Group K1 (Treatment Control): They were given standard feed of Bravo-512 and CMC (Carboxymethyl Cellulose) solution by means of a round for 8 weeks;
Group K2 (Negative Control): were given standard feed Bravo-512 with high fat feed and Simvastatin dose of 0.72 mg / day by means of a round for 8 weeks; Group K3 (Positive Control): Was given a mixture of standard feed Bravo-512 with high fat feed and CMC (Carboxymethyl Cellulose) by means of a round for 8 weeks; Group K4 (Control Treatment 1): Given a mixture of standard Bravo-512 feed with high-fat feed and red dragon fruit extract 60 mg / 200 grBB / day by means of a round for 8 weeks; Group K5 (Control
treatment 2): Was given a mixture of standard Bravo-512 feed with high fat feed and red dragon fruit extract 60 mg / 200 grBB / day by means of a round for 16 weeks.

**Surgical Procedure And Sperm Sampling**

Termination and quality analysis of spermatozoa was carried out after treatment given to Wistar rats for 52 and 104 days.

Performing mouse surgery and observing the motility of mouse spermatozoa by: Performed surgery by taking the mouse cauda epididymis, the cauda epididymis is cut cross-sectional finely to take mouse spermatozoa, the mouse spermatozoa that have been taken are immediately dropped into a glass object and covered with a glass cover. In order to check the motility of spermatozoa, it is only allowed within 30-60 minutes of the specimens to be taken 19, that the Object glass is placed on a light microscope and observed at 400x magnification, determining and comparing the percentage of spermatozoa motility.

**Data analysis technique**

Descriptive analysis was conducted to determine the mean (mean), standard deviation (SD), homogeneity test and normality test. Normality test to determine whether the research data is normally distributed or not with the Shapiro-Wilk test. The homogeneity test was carried out to determine whether the research data was homogeneous or not, carried out as a condition for the ANOVA test 20

**Analytical Analysis**

The results of the study were analyzed using the One Way Anova test because the dependent and independent variables were numerical and there were more than 2 variables. By using this test it can be seen the effect of the independent variable on the dependent variable. To perform the One Way Anova test, the data obtained must be normally distributed and homogeneous data variants. The data normality test was performed using the Shapiro-Wilk test, the data were normally distributed if p > 0.05. After the normality test, the data homogeneity test was carried out with the Levene test, if p > 0.05, the data was homogeneous. If the data is normally distributed and the variance of the data is homogeneous, the One Way Anova test is performed. If it does not meet the requirements, the Kruskal Wallis test is performed. To find out which group has differences, a Post Hoc test is carried out after One Way Anova 21

**3. Results**

Based on observations in this study, the percentage of spermatozoa motility of male white rats (Rattus norvegicus) was calculated. The data obtained from the calculation of the percentage of each treatment group is as shown in the graph below

Based on the graph above, it shows descriptively that the mean percentage of motility of the treatment control group has a value of 43.2%. According to WHO (2010) normal motility is when PR ≥ 32% or PR + NP value > 40%, so that the treatment control group has a normal mean motility. However, there was an average decrease in the negative control group with a value of 16.47%. The average percentage of mouse spermatozoa motility increased in the treatment group by giving red dragon fruit extract (Hylocereus polyrhizus), with the largest average found in the red dragon fruit group with a dose of 60 mg / 200 grBB / day for 104 days, namely 51.2%.

**Motility Statistics Test of Mouse Spermatozoa**

The results obtained were analyzed with statistical software using the One Way Anova method because the dependent variable and independent variable had a numerical data scale and this study was comparative because it wanted to compare the effect of giving red dragon fruit extract (Hylocereus polyrhizus) on the motility of spermatozoa given high-fat feed induction.

**Data Normality Test**

To perform the Anova test, the requirements must be met, namely the data must be normally distributed
and have homogeneous variance. Because the sample size is ≤ 50, the Sapiro-Wilk normality test is performed. The results of the normality test are as follows.

Based on table 1, the results of the Shapiro-Wilk normality test showed that the significance value of all groups was more than 0.05 (p>0.05) so that all data were normally distributed.

### Homogeneity Test of Variance

The results of the variance homogeneity test of this study can be seen in table 2.

Based on table 2, the results of the variance homogeneity test showed that the significance value of all groups was more than 0.05 (p>0.05), so it was concluded that the data variance was homogeneous.

After it was found that the data were normally distributed and had homogeneous variances, the Anova test could be performed.

### One Way Anova test

All the Anova test requirements have been fulfilled, namely consisting of normally distributed data and homogeneous data variance, then the One Way Anova test can be carried out.

From Table 3, the results of the One Way Anova test showed that spermatozoa motility had a significance value of less than 0.05 (p <0.05). It can be concluded that there were significant differences in at least two groups.

### Post Hoc Test

To find out which groups had significant differences with other groups, a post hoc analysis was carried out. Post Hoc LSD was used because the One Way Anova test showed significant differences and homogeneous data variance21.

Based on table 4, the results of the Post Hoc LSD test on spermatozoa motility showed that the treatment control group had a significance value of 0.006 (p <0.05) with the negative control group so that it had a significant difference. The negative control group has a significance value (p <0.05) with the other two groups so that there is a significant difference.
Table 1 Data Normality Test

| Treatment Group                                      | Shapiro-Wilk | df | Sig. |
|------------------------------------------------------|--------------|----|------|
| Treatment Control                                    | .890         | 5  | .355 |
| Negative Control                                     | .965         | 5  | .843 |
| Simvastatin dose of 0.72 mg / day                    | .877         | 5  | .296 |
| Red dragon fruit 60 mg / 200 grBB / day for 52 days  | .914         | 5  | .495 |
| Red dragon fruit 60 mg / 200 grBB / day for 104 days | .816         | 5  | .110 |

Source: Primary Data, 2020

Table 2 Data Homogeneity Test

| Test | Material | Levene Statistics | Df1 | Df2 | Sig. |
|------|----------|-------------------|-----|-----|------|
| Sperm Motility | 1.523 | 4 | 20 | .233 |

Source: Primary Data, 2020

Table 3 One Way Anova Test

| Motility Percentage | Sum of Squares | df | Mean Square | F   | Sig. |
|---------------------|----------------|----|-------------|-----|------|
| Between Groups      | 3630.230       | 4  | 907.557     | 4.809 | 0.07 |
| Within Groups       | 3774.168       | 20 | 188.708     |      |      |
| Total               | 7404.398       | 24 |             |      |      |

Source: Primary Data, 2020

| Category | Category | Sig. | Explanation |
|----------|----------|------|-------------|
| Treatment Control | Negative Control | .006 | meaningful |
| Simvastatin dose of 0.72 mg / day | .323 | meaningless |
| Red dragon fruit 60 mg / 200 grBB / day for 52 days | .865 | meaningless |
| Red dragon fruit 60 mg / 200 grBB / day for 104 days | .380 | meaningless |
| Negative Control | Treatment Control | .006 | meaningful |
| Simvastatin dose of 0.72 mg / day | .050 | meaningless |
| Red dragon fruit 60 mg / 200 grBB / day for 52 days | .004 | meaningful |
| Red dragon fruit 60 mg / 200 grBB / day for 104 days | .001 | meaningful |
| Red dragon fruit 60 mg / 200 grBB / day for 52 days | .865 | meaningless |
| Simvastatin dose of 0.72 mg / day | .004 | meaningful |
| Red dragon fruit 60 mg / 200 grBB / day for 52 days | .250 | meaningless |
| Red dragon fruit 60 mg / 200 grBB / day for 104 days | .477 | meaningless |

Source: Primary Data, 2020
Simvastatin dose of 0.72 mg / day
Red dragon fruit 60 mg / 200 grBB / day for 52 days
Red dragon fruit 60 mg / 200 grBB / day for 104 days

(Source: Primary Data, 2020)

4. Discussion

Discussion of Control Group Results

The results showed that a diet high in fat will cause damage to the spermatozoa motility of Wistar rats. This was indicated by a significant decrease in motility (p <0.05) in the negative group which was given high-fat feed from the control group that was not given high-fat feed in the Post Hoc LSD analysis test.

This is because a high-fat diet in mice can cause hypercholesterolemia which plays an important role in the production of free radicals and excessive lipid peroxidation at the tissue level which is oxidant to gonad cells, causing degeneration of these gonad cells, and can also reduce antioxidant enzymes. (superoxide dismutase, catalase, growth stimulating hormone, glutantiane peroxidase), so that this further supports the decrease in the quality and quantity of spermatozoa.

Excess amounts of free radicals or reactive oxygen (Reactive Oxygen Species-ROS) can damage spermatozoa motility. Free radicals will attack the plasma membrane and initiate lipid oxidation. The double bonds of unsaturated fatty acids will be attacked by free radicals and form lipid peroxide radicals. Lipid peroxide will react with the lipid molecules around it which will cause a chain reaction and cause oxidation of the plasma membrane. This oxidation of lipids in the plasma membrane causes a decrease in flexibility and inhibition of the motility mechanism of the spermatozoa.

Free radicals have the ability to directly damage DNA by attacking purines and pyrimidines. Free radicals cause damage by breaking single and double-chain DNAs. High levels of ROS damage mitochondrial DNA resulting in decreased energy production and ATP.

Damage to the plasma membrane accompanied by damage to mitochondrial DNA decreases the motility of spermatozoa.

The results of the study that showed a decrease in motility in the high-fat feed group (negative control group) compared to the group that was not given high-fat feed (the treatment control group) were in line with a study conducted by Sopia 2009 which stated that hyperlipidemia could interfere with the ripening process. spermatozoa resulting in decreased motility of spermatozoa.

Previous studies have shown that peroxidation of fat can decrease the rate of spermatozoa. This is because the speed of the spermatozoa is determined by the movement of the tail and meanwhile the movement of the tail is affected by the acidity in the body. The lower the acidic atmosphere in the body, the sperm will move faster. It is also possible that the decrease in the speed of movement of the spermatozoa is caused by an increase in cholesterol contained in the semen which can interfere with the contraction of the fibrils in the spermatozoa tail so that the movement of the spermatozoa tail is reduced so that the motion becomes slower.

Other studies have also stated that there is a significant reduction in sperm concentration and the percentage of motile spermatozoa, because in hypercholesterolemic conditions, it is also associated with defects in the secretion function of the Sertoli and Leydig cells which make spermatogenesis imperfect and spermatozoa maturation in the epididymis, resulting in decreased sperm motility and increased abnormalities.

Discussion of Treatment Group Results
Research in the treatment group given red dragon fruit 60 mg / 200 grBB / day for 104 days and red dragon fruit 60 mg / 200 grBB / day for 52 days had a higher average motility than the Simvastatin group at a dose of 0.72 mg / day. This shows that there is a significant difference between the group given red dragon fruit 60 mg / 200 grBB / day for 104 days with the negative control group, then there is also a significant difference between the groups given red dragon fruit 60 mg / 200 grBB / day for 52 days with the negative control group. This shows that the red dragon fruit extract can protect spermatozoa so that it can increase spermatozoa motility even more than normal.

Red dragon fruit extract 60 mg / 200 grBB / day for 104 days and Red dragon fruit extract 60 mg / 200 grBB / day for 52 days is the optimal dose because the treatment group with simvastatin dose 0.72 mg / day did not have a significant difference with negative control group. This shows that the mean spermatozoa motility in the group given simvastatin dose of 0.72 mg / day was able to increase spermatozoa motility but had not yet reached the average limit of normal motility.

Treatment group 1 which was given red dragon fruit extract 60 mg / 200 grBB / day for 52 days had an average spermatozoa motility that was higher than the negative control group which was only given high-fat feed showed that the red dragon fruit extract dosage of 60 mg / 200 grBB / day can protect spermatozoa from high-fat feed.

The second treatment group which was given red dragon fruit extract 60 mg / 200 grBB / day for 104 days had a higher mean spermatozoa motility than the negative control group which was only given high-fat feed. The insignificant difference between treatment group 2 and treatment control group, positive control group, and treatment group 1 showed that the red dragon fruit extract at a dose of 60 mg / 200 grBB / day had high antioxidant activity.

The given of red dragon fruit extract in treatment groups 1 and 2 indicates that there is no significant difference between treatment groups 1 and 2. Based on this, the effect of giving red dragon fruit extract on spermatozoa motility chronically or in two cycles of spermatogenesis is the same as giving for one cycle spermatogenesis and does not cause death in mice, this is supported by previous research which states that the administration of red dragon fruit extract acutely and subchronic is relatively safe as long as it does not pass the lethal dose of 1000 mg / day.

The results showed that the red dragon fruit extract at a dose of 60 mg / 200 grBB / day for 52 days and 104 days could be a source of antioxidants. This is because red dragon fruit has phenol and vitamin C antioxidants. Phenolic compounds can stabilize free radicals by quickly giving hydrogen atoms to free radicals, while radicals derived from antioxidant phenol compounds will be more stable than free radicals. Phenolic compounds also have the ability to negate peroxide radicals and free radicals so they are effective in inhibiting lipid oxidation. Vitamin C has been proven to be a strong antioxidant. Vitamin C or L-ascorbic acid contained in red dragon fruit is one of the antioxidants that acts as an ROS scavenger and has high polarity properties because it contains a lot of hydroxyl groups so that it is easily dissolved in water. That vitamin C can react and is also able to neutralize free radicals, both in terms of induced DNA damage and excessive ROS production, so that vitamin C can improve sperm quality. Red dragon fruit has high levels of ascorbic acid, where ascorbic acid also has an important role for DNA protection in sperm.

The results of this study are in line with the research conducted by Prakoso 2007 which examined the effect of red dragon fruit extract and white dragon fruit extract on total cholesterol levels of white rats which stated that red dragon fruit extract has a potential effect in improving hypercholesterolemic conditions, so red dragon fruit extract can improve spermatozoa motility of mice that are fed high fat feed.

Based on the results of this study it can be concluded that giving red dragon fruit extract 60 mg / 200 grBB / day for 104 days and red dragon fruit extract 60 mg / 200 grBB / day for 52 days can increase the motility of rat spermatozoa beyond the
normal average, while giving Simvastatin at a dose of 0.72 mg / day can increase the motility of spermatozoa near the normal mean of spermatozoa motility of white rats, and does not cause death in experimental animals.

Research Limitations

This study used a posttest-only control-group design because this study was carried out by harvesting organs that can only be done after treatment, so that the motility of the rat spermatozoa before treatment could not be known. This study was conducted during the daytime, whereas rats were nocturnal animals. This is because the research was conducted at the Pharmacology and Therapeutic Laboratory of the Faculty of Medicine, Padjadjaran University, so it was not possible to conduct research at night.

5. CONCLUSION

Based on the results, analysis, and discussion of research giving red dragon fruit extract (Hylocereus polyrhizus) on spermatozoa motility of wistar rats (Rattus norvegicus) induced high-fat feed, the following conclusions were obtained:

a. The mean percentage of spermatozoa motility in the control group for the treatment without high-fat feed was 43.4%.

b. The mean percentage of spermatozoa motility in the negative control group which was given high-fat feed was 16.47%.

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