# The Effect Of Vitamin-C Supply On Cardiorespiratory Endurance In Hockey Athletes

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# The Effect Of Vitamin-C Supply On Cardiorespiratory Endurance In Hockey Athletes

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**Abstract**

This study is an experimental study aimed at determining the effect of vitamin C administration on cardiorespiratory endurance in UNM hockey athletes. The independent variable in this study is the administration of vitamin C, while the dependent variable is cardiorespiratory endurance. The population in this study were all male Hockey athletes of the Faculty of Sport Sciences, Makassar State University, while the sample was 14 male Hockey athletes from UNM. The data collection technique used was a multistage fitness test or bleep test. Data analysis used descriptive statistical analysis techniques and statistical analysis techniques. The results of descriptive statistics were obtained from the results of tests given to UNM hockey athletes. The results of statistical analysis by conducting hypothesis testing using the Paired Sample T-test on the post-test showed that the probability value = 0.007 so it was smaller than the significance level value of 5% (0.007 <0.05). The conclusion of this study shows that there is a significant effect of vitamin C administration on cardiorespiratory endurance in UNM hockey athletes.

Keywords: Vitamin C; Endurance; Cardiovascular; Athlete; Hockey.

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## A. Introduction

Sports are a way to increase physical fitness so that the quality of human resources can be improved through physical activities with certain rules. Other systems also participate when exercising which involve the musculoskeletal system alone, but also include various other systems such as the blood vascular system, excretory system, respiratory system, nervous system, and various other systems (Maulana et al., 2019). According to Herwin (2006) stated that: Sports are carried out with various purposes, such as aiming to simply fill free time, recreation, reduce stress levels, fitness, health, or achieve achievements in the field of sports (Kusuma et al., 2019). Sports are individual or team in nature which have the aim of achieving achievements requiring a detailed and measured training process correctly and well (Arifin et al., 2019).

But in general, the purpose of sports is to maintain health, improve physical fitness, increase human enthusiasm for sports as a means of recreation and maintain and increase achievements according to the sport of interest (Masithoh et al., 2018). Types of sports that aim to increase achievements can be divided according to the total number of players, namely individual sports and team or group sports. Sports that are included in individual sports such as martial arts, athletics, and swimming. Sports that are included in team sports are football, volleyball and hockey.

One of the most popular sports is hockey. Hockey is a sport played by men and women using a stick or bat and a ball. This type of sport is also a sport that is competed in various national and even international sports competitions such as PON, Kejurnas, Asean Games, and others. According to Subakti (2013), Hockey consists of 11 (eleven) players each including the goalkeeper who are divided into 2 (two) opposing or facing groups. The goal of this game is to be able to put as many balls as possible into the opponent's goal by following the applicable game rules. A team is declared the winner if the team can score more goals than the other team. To be able to play quickly and accurately, of course, good physical condition is needed because all activities require good energy and endurance. Hockey is not much different from soccer, both games aim to score goals in the opposing team's goal. However, the difference is that hockey uses a bat or stick while soccer uses feet.

According to Partibani (2012), developing physical fitness, especially endurance, strength and speed are things needed to become a hockey player (Aristiyanto et al., 2021). The game of hockey requires several elements that can support achievement, including physical condition, mastery of techniques, tactics and mental strength (Parahita, 2019). To develop these components well, the most basic thing to be

able to develop other components is the physical component (Metikasari & Roepadjadi, 2020). In line with the opinion of Purwanto (2004:41) "the game of hockey requires good physical condition such as (1) aerobic endurance, (2) anaerobic endurance, (3) speed, (4) agility, (5) strength, and (6) muscle endurance". Every hockey player is expected to have good endurance quality in facing a championship (Latifah et al., 2019). The maximum endurance possessed by hockey players makes the players not get tired quickly during training or matches (Rosiadi & Roepajadi, 2022). To maintain physical fitness by carrying out physical activities for a long time without experiencing fatigue, hockey requires cardiorespiratory endurance because the oxygen released from the lungs is maximum (Priyanggono & Kumaat, 2021).

Factors that influence endurance are internal factors (from within and external factors. Internal factors are things that already exist in the human body that are permanent such as genes, age, exercise time, and gender (Sasmarianto & Nazirun, 2022). Various factors that influence cardiorespiratory endurance include exercise and physical activity, nutritional status, haemoglobin or blood status, adequacy and nutrition (Sasmarianto et al., 2020). External factors are something that comes from outside the human body in the form of physical activity that requires energy, dietary factors (Nurhikmawati et al., 2021), and environmental factors and other factors. Therefore, to have prime endurance, it is not enough to just do physical exercise it is necessary (Wildayani et al., 2023) accompanied by the fulfilment of nutrition, especially vitamins (Rum et al., 2022).

Based on the results of observations at the FIK UNM Hockey arena, when hockey players do activities that involve physical activity such as when practising or competing, their endurance is less than optimal. Several players appear to be experiencing fatigue with a duration of physical activity that is not too long, which of course hurts team performance during the match (Septiani, 2024). It also appears that there is no provision of vitamins or other supplements for athletes (Putri, 2023). This is common in the preparation of training programs that only pay attention to the frequency and intensity of training (Iham et al., 2024) while other factors that reduce athlete endurance are low nutritional control and the fulfilment of multivitamins and other intakes (Usman et al., 2023).

The endurance of UNM hockey athletes should be maximized not only with high-intensity training but also with adequate intake of vitamins and supplements. So that

athletes can play optimally. A fairly important vitamin is vitamin C which functions to increase the immune system, prevent ageing, form collagen, and various other benefits (Khumaedi et al., 2023). Vitamin C is also fairly easy to obtain in various types of food or processed foods. According to William (Halimah, 2014), decreased endurance and weakened muscle contractions are caused by vitamin deficiencies. In line with the opinion of Sukadianto (2011) who stated that poor endurance will make players less able to carry out explosive activities or activities with high intensity (Nurgrum & Dewi, 2024).

Consuming vitamin C is an effective, efficient, and delicious solution for athletes to restore their stamina and strength (Jayaputra & Putriningtyas, 2024). This vitamin is needed for the development and maintenance of the function of body organs. And plays an important role in maintaining endurance. Vitamin supplementation has been shown to affect athlete endurance by delaying fatigue (Rahmat, 2024).

## B. Method

This study uses a quantitative approach. The research design used in this study is one group pretest-post-test design. This study does not use a comparison group but has used an initial test so that the magnitude of the effect or influence of vitamin C administration on cardiorespiratory endurance can be known with certainty. In this study, there is only one group that functions as a control group (before being given treatment) and an experimental group (after being given treatment). In simple terms, the research design used can be described as follows:

**Table 1.** Research Design one group pretest-post-test design

| Pretest | Treatment | Post-test |
|---|---|---|
| $O_1$ | X | $O_2$ |

The population in this study were all male Hockey athletes of the Faculty of Sport Science, Makassar State University, totalling 25 people. The sampling technique was simple random sampling. The researcher randomly selected the names of athletes who would be given treatment. So the number of samples used in this study was 7 male Hockey athletes of the Faculty of Sport Science and Health, Makassar State University.

In a scientific study, data is a very important part and cannot be ignored. Because the sustainability of a study requires data to be analyzed to draw definite and correct conclusions. Data collection in this study used the test and measurement method to measure blood pressure using a

modified test instrument because there is no standard test instrument to measure.

The data to be collected in this study is by the variables involved, namely cardiorespiratory endurance data in hockey athletes using the Multistage Test.


**Figure 1.** Multistage Fitness Test

The instrument used in this study is a physical fitness test in the form of MFT (Multistage Fitness Test). In data processing in this study, there are two prerequisite tests, namely the normality test and the homogeneity test. After being declared to meet the prerequisite test, it will be continued with a hypothesis test.

Parametric statistical tests are procedures in statistical hypothesis testing to conclude. Parametric statistical tests assume that the data has been normally distributed and is homogeneous. SPSS enables researchers to perform various parametric statistical tests.

## C. Results and Discussion

### Results

#### UNM Hockey Athletes Pretest Data on Cardiorespiratory Endurance of Experimental Group

Pretest of cardiorespiratory endurance of athletes in the experimental group. The pretest data of the experimental group can be seen in the following Table:

**Table 2.** Description of Cardiorespiratory Endurance Statistics VO2Max Pretest Athletes Experimental Group

| Descriptive Statistics | Statistical Values |
|---|---|
| Number of Samples | 7 |
| Lowest-value | 32.40 |
| Highest-value | 45.50 |
| Mean | 40.71 |
| Range | 13.10 |
| Standard Deviation | 4.53 |
| Median | 36.8 |

Based on Table 2, it can be seen that the average (mean) cardiorespiratory endurance of the experimental group is 40.71, while the middle value (median) is 36.8. The standard deviation is 4.53, the highest (maximum) value obtained is 45.50 while the lowest (minimum) value obtained is 32.40 and the range of values (range) including the highest

and lowest-values is 13.10. The frequency distribution of the pretest results of cardiorespiratory endurance of athletes in the experimental group can be seen in the following table:

**Table 3.** Distribution and Percentage of VO2 Max Pretest Results of Athletes in the Experimental Group

| No | VO2 Max | Category | F | % |
|---|---|---|---|---|
| 1 | >51.6 | Very Good | 0 | 0 |
| 2 | 42.6 - 51.5 | Good | 2 | 28,6 |
| 3 | 33.8 - 42.5 | Currently | 4 | 57,1 |
| 4 | 25,0 – 33,7 | Less | 1 | 14,2 |
| 5 | <25.0 | Very less | 0 | 0 |
| **Total** | | | **7** | **100** |

Based on the frequency table, it is known that the number of athletes who obtained a very good category score was 0 people with a percentage of 0%. The number of athletes who obtained a good category was 2 people with a percentage of 28.6%. The number of athletes who obtained a moderate category was 4 people with a percentage of 57.1%. The number of athletes who obtained a less-than-good category was 1 person with a percentage of 14.2%. Based on the results of the descriptive analysis that has been carried out, it can be concluded that the pretest results in the experimental group are in the moderate category, this can be seen based on the average (mean) value of cardiorespiratory endurance in the experimental group as a whole amounting to 40.71.

**UNM Hockey Athletes Pretest Data on Cardiorespiratory Endurance of the Control Group**

Pretest of cardiorespiratory endurance of athletes in the control group. The pretest data of the control group can be seen in the following table:

**Table 4.** Statistical Description of Cardiorespiratory Endurance VO2Max Pretest Control Group

| Descriptive Statistics | Statistical Values |
|---|---|
| Number of Samples | 7 |
| Lowest-value | 33.60 |
| Highest-value | 44.90 |
| Mean | 39.45 |
| Range | 11.30 |
| Standard Deviation | 4.26 |
| Median | 40.8 |

Based on Table 4, it can be seen that the average (mean) of the control group is 39.45, while the middle value (median) is 40.8. The standard deviation is 4.26, the highest (maximum) value obtained is 44.90 while the lowest (minimum) value obtained is 33.60 and the range of values (range) including the highest and lowest-values is

11.30. The frequency distribution of the pretest results of the cardiorespiratory endurance of the control group athletes can be seen in the following table:

**Table 5.** Distribution and Percentage of VO2 Max Pretest Results of Athletes in the Control Group

| No | VO2 Max | Category | F | % |
|---|---|---|---|---|
| 1 | >51,6 | Very Good | 0 | 0 |
| 2 | 42.6 - 51.5 | Good | 1 | 14,2 |
| 3 | 33.8 - 42.5 | Currently | 5 | 71,4 |
| 4 | 25,0 – 33,7 | Less | 1 | 14,2 |
| 5 | <25,0 | Very less | 0 | 0 |
| | **Total** | | 7 | **100** |

Based on the frequency table, it is known that the number of athletes who obtained a very poor category score was 0 people with a percentage of 0%. While the number of athletes who obtained a moderate category was 1 person with a percentage of 14.2%. The number of athletes who obtained a moderate category was 5 athletes with a percentage of 71.4%. The number of athletes who obtained a good category was 1 person with a percentage of 14.2%. The number of athletes who obtained a very good category was 0 athletes with a percentage of 0%. Based on the results of the descriptive analysis that has been carried out, it can be concluded that the pretest results in the control group are in the moderate category, this can be seen based on the average (mean) value of cardiorespiratory endurance in the control group as a whole amounting to 39.45.

**UNM Hockey Athletes Post-test Data on Cardiorespiratory Endurance of the Experimental Group**

Post-test of cardiorespiratory endurance of athletes in the experimental group. The post-test data of the experimental group can be seen in the following table:

**Table 6.** Statistical Description of Post-test Cardiorespiratory Endurance of Athletes in the Experimental Group

| Descriptive Statistics | Statistical Values |
|---|---|
| Number of Samples | 7 |
| Lowest-value | 43,30 |
| Highest-value | 51,60 |
| Mean | 47,84 |
| Range | 8,30 |
| Standard Deviation | 3,57 |
| Median | 49 |

Based on Table 6, it can be seen that the average (mean) of the experimental group is 47.84, while the middle value (median) is 49. The standard deviation is 3.57, the highest (maximum) value obtained is 51.60 while the lowest (minimum) value obtained is 43.30 and the range of values between the highest and lowest values is 8.30. The

frequency distribution of the post-test results of the cardiorespiratory endurance of the experimental group athletes can be seen in the following table:

**Table 7.** Distribution and Percentage of VO2 Max Post-tesT-test Results of Athletes in the Experimental Group

| No | VO2 Max | Category | F | % |
|---|---|---|---|---|
| 1 | >51,6 | Very Good | 1 | 14,28 |
| 2 | 42.6 - 51.5 | Good | 6 | 85,71 |
| 3 | 33.8 - 42.5 | Currently | 0 | 0 |
| 4 | 25,0 – 33,7 | Less | 0 | 0 |
| 5 | <25,0 | Very less | 0 | 0 |
| | **Total** | | 7 | **100** |

Based on the frequency table 7, it is known that the number of athletes who obtained a very poor category score was 0 people with a percentage of 0%. While the number of athletes who obtained a moderate category was 0 people with a percentage of 0%. The number of athletes who obtained a moderate category was 0 athletes with a percentage of 0%. The number of athletes who obtained a good category was 1 person with a percentage of 85.71%. The number of athletes who obtained a very good category was 1 athlete with a percentage of 14.28%. Based on the results of the descriptive analysis that has been carried out, it can be concluded that the post-test results in the experimental group are in the good category, this can be seen based on the average (mean) value of cardiorespiratory endurance in the control group as a whole amounting to 47.84.

**UNM Hockey Athletes Post-test Data on Control Group Cardiorespiratory Endurance**

Post-test of cardiorespiratory endurance of athletes in the control group. The post-test data of the control group can be seen in the following table:

**Table 8.** Description of Post-test Scores of Athletes in the Control Group

| Descriptive Statistics | Statistical Values |
|---|---|
| Number of Samples | 7 |
| Lowest-value | 33,60 |
| Highest-value | 45,20 |
| Mean | 40,04 |
| Range | 11,60 |
| Standard Deviation | 3,94 |
| Median | 41,8 |

Based on Table 8, it can be seen that the average (mean) of the control group is 40.04, while the middle value (median) is 41.8. The standard deviation is 3.94, the highest (maximum) value obtained is 40.04 while the lowest (minimum) value obtained is 45.20 and the range of values (range) between the highest and lowest values is 11.60.

**Table 9.** Distribution and Percentage of Post-test Scores of Athletes in the Control Group

| No | VO2 Max | Category | F | % |
|---|---|---|---|---|
| 1 | >51,6 | Very Good | 0 | 0 |

| No | VO2 Max | Category | F | % |
|---|---|---|---|---|
| 2 | 42.6 - 51.5 | Good | 1 | 14,28 |
| 3 | 33.8 - 42.5 | Currently | 5 | 71,42 |
| 4 | 25,0 - 33,7 | Less | 1 | 14,28 |
| 5 | <25,0 | Very less | 0 | 0 |
| | **Total** | | **7** | **100** |

Based on the frequency table, it is known that the number of athletes who obtained a very poor category score was 0 people with a percentage of 0%. While the number of athletes who obtained a moderate category was 1 person with a percentage of 0%. The number of athletes who obtained a moderate category was 0 athletes with a percentage of 14.28%. The number of athletes who obtained a good category was 1 person with a percentage of 71.42%. The number of athletes who obtained a very good category was 1 athlete with a percentage of 14.28%. Based on the results of the descriptive analysis that has been carried out, it can be concluded that the post-test results in the experimental group are in the moderate category, this can be seen based on the average (mean) value of cardiorespiratory endurance in the control group as a whole amounting to 40.04.

**Data Analysis Assumption Test**

**Normality Test**

The normality test was conducted to determine whether the data in the experimental group and the control group were normally distribated or not. The normality test in this study used Kolmogorov-Smirnov. Data is said to be normally distributed if the probability value in the Kolmogorov-Smirnov test output is greater than the specified ∝ value, which is 95% (0.05). A summary of the data from the pretest and post-test normality tests in the experimental group and the control group can be seen in the following table:

**Table 10.** Results of the Normality Test of Pretest and Post-test Data for the Experimental and Control Groups

| Data | Probability Value | Information |
|---|---|---|
| Experimental Group Pretest | 0,240 | 0,240 > 0,05 = normal |
| Pretest Control Group | 0,200 | 0,200 > 0,05 = normal |
| Experimental Group Post-test | 0,200 | 0,200 > 0,05 = normal |
| Control Group Post-test | 0,200 | 0,200 > 0,05 = normal |

Based on the data, it shows that the pretest and post-test data of the experimental and control groups are normally distributed. This can be seen from the results of the normality test on the four data obtained with a probability value greater than 0.05. Thus, it can be concluded that the data of the experimental and control

groups are normally distributed.

**Homogeneity Test**

A homogeneity test is conducted to determine whether the data from both samples are homogeneous. The homogeneity test in this study uses the Levene Test. Data is said to be homogeneous if the probability value in the Levene Statistic output is greater than the specified α value, which is 95% (0.05). A summary of the data from the pretest and post-test homogeneity tests in the experimental and control groups can be seen in the following table:

**Table 11.** Results of Pretest and Post-test Homogeneity Test of Experimental and Control Groups

| Data | Probability Value | Information |
|---|---|---|
| Pretest of Experimental and Control Groups | 0,992 | 0,992 > 0,05 = homogen |
| Post-test of Experimental and Control Groups | 0,896 | 0,896 > 0,05 = homogen |

Based on the data, it shows that the results of the homogeneity test of the pretest of the experimental group and the control group as well as the post-test of the experimental group and the control group are said to be homogeneous because the probability value is greater than 0.05. After obtaining the results of the homogeneity test of the experimental group and the control group, the next step is to conduct a parametric test or t-test because the requirements that must be met before conducting a parametric test or t-test are that the two groups of data being tested must be homogeneous.

**Hypothesis Testing**

**Independent Sample T-Test Pretest Experiment and Pretest Control**

This analysis was conducted by testing the results of the pretest of the experimental group and the pretest of the control group. The following are the results of the Independent Sample t-test of the pretest-values of the experimental group and the pretest of the control group.

**Table 12.** Independent Sample T-Test Pretest Experiment and Pretest Control

| T | Df | Probability Value | Information |
|---|---|---|---|
| 0,354 | 12 | 0,603 | 0,603 > 0,05 = no difference |

Based on the table above, it can be seen that the probability value is greater than 0.05, it is known that there is no significant difference in cardiorespiratory endurance between the experimental group and the control group before being given treatment. If the calculated t-value of 0.354 is compared to the t-table value with a value of α = 5% and df = 12, the table value is 1.782. So the calculated t has a smaller value than the t-table (0.354 <1.782). If the calculated t < t-table then it can be concluded that there is no

significant difference.

**Independent Sample T-Test Post-test Experiment and Post-test Control**

This analysis aims to determine the differences in cardiorespiratory endurance of athletes between groups that follow training by consuming vitamin C and groups that follow training without consuming vitamin C. This analysis was conducted by testing the results of the post-test of the experimental group and the post-test of the control group. The following are the results of the Independent Sample T-Test of the post-test-values of the experimental group and the post-test of the control group.

**Table 13.** Independent sample T-Test Post-test Experiment and Post-test Control

| T | Df | Probability Value | Information |
|---|---|---|---|
| 3.878 | 12 | 0,000 | 0,000 < 0,05 = ada perbedaan |

Based on the table, it can be seen that the probability value is less than 0.05. This shows that there is a significant difference in the cardiorespiratory endurance of athletes in the group who participated in training by consuming vitamin C and the group who participated in training without consuming vitamin C. If the calculated t-value of 3.878 is compared to the t-table value with α = 5% and df = 12, the t-table value is 1.782. So the calculated t has a value greater than the t-table (3.878> 1.782). If the calculated t > t-table, it can be concluded that there is a significant difference.

**Paired Sample T-test Post-test Experimental Group**

This analysis aims to determine the difference in cardiorespiratory endurance of athletes before the experimental group consumed vitamin C and after the group consumed vitamin C. This analysis was conducted by testing the results of the pretest and post-test of the experimental group. This analysis was conducted with the help of the IBM SPSS Statistic Version 22 program. The data requirement is said to have a difference if the probability value is less than 0.05. The following are the results of the Paired Sample T-test Pretest and Post-test of the Experimental Group.

**Table 14.** Paired Sample T-Test Post-test Experimental Group

| T | Df | Probability Value | Information |
|---|---|---|---|
| 3.992 | 6 | 0,007 | 0,007 < 0,05 = There is a difference |

Based on the table, it can be seen that the probability value is less than 0.05. This indicates that there is a significant difference in the cardiorespiratory endurance of the experimental group in athletes before and after consuming vitamin C. If the calculated t-value

of 3.992 is compared to the t-table value with α = 5% and df = 6, the t-table value is 1.943. So the calculated t has a value greater than the t-table (3.992> 1.943). If the calculated t> t-table, it can be concluded that there is a significant difference before and after being given treatment in the form of vitamin C, So it can be said that vitamin C affects the cardiorespiratory endurance of athletes.

**Discussion**

The subjects of this study consisted of two groups, namely the control group and the experimental group. The experimental group consisted of 7 athletes, all of whom were male. While the control group consisted of 7 people, all of whom were male. Both groups were given a pretest as an initial test in the form of a bleep test. Then the experimental group was given treatment in the form of vitamin C, while the control group was not given any treatment. Furthermore, both groups were given a post-test as a final test.

The data collection technique used was by using a bleep test or multistage fitness test, the results of which were categorized using standardization norms for VO2Max with a bleep test for ages 20-29 years from Ismayati (2006). There were two data analysis techniques used, namely data processing using descriptive statistics and inferential statistics. Descriptive statistical processing to state the frequency distribution of respondents' scores or describe the cardiorespiratory endurance of athletes. This study was conducted by providing vitamin C treatment to the experimental group and without any treatment to the control group. This was done to determine whether there was an effect of vitamin C administration on cardiorespiratory endurance in UNM hockey athletes by comparing the post-test results of the experimental group and the control group.

In the descriptive statistical analysis, it was found that the cardiorespiratory endurance of athletes in the experimental group before being given vitamin C treatment was in the moderate category and after being given vitamin C treatment, the cardiorespiratory endurance of athletes increased and was in the good category. While in the control group before and after being given treatment without vitamin C, cardiorespiratory endurance did not increase, because the results of the bleep test showed that the cardiorespiratory endurance of athletes remained in the moderate category. This illustrates that there is a difference in the cardiorespiratory endurance of athletes between the groups given vitamin C treatment and those without vitamin C.

In the inferential statistical analysis, the assumption test is first carried out, namely the normality test and the homogeneity test. The normality test of the pretest and post-test of the cardiorespiratory endurance of athletes in the experimental and control groups used the Kolmogorov-Smirnov test with the results of

all data being normally distributed. After that, a homogeneity test was carried out between the pretest of the experimental and control groups, and the post-test of the experimental and control groups using Levene's test with the results of both data groups being declared homogeneous. After conducting both tests, a hypothesis test was carried out.

Based on the hypothesis test with inferential statistics, it shows that there is a significant influence on the cardiorespiratory endurance of athletes after being given treatment in the form of vitamin C during the training process. The results of the hypothesis test were carried out in two ways, namely comparing t-table and t-count and comparing probability values.

Calculation of the pretest results of the experimental group and control group using manual calculations for the independent sample t-test combined with the assistance of the SPSS 22.0 program obtained a t-table value with df(12)=1.782 while the calculated t-test results for the athlete's bleep test were 0.534, calculated t (0.534) < t-table (1.782) so that Ho was rejected and Ha was accepted without looking at positive (+) or negative (-).

Calculation of the post-test results of the experimental group and the control group using manual calculations for the independent sample t-test combined with the help of the SPSS 22.0 program obtained a t-table value with df (12) = 1.782 while the t-count of the athlete's bleep test results was 3.878, t-count (3.878) > t-table (1.782) so that Ho was rejected and Ha was accepted without looking at positive (+) or negative (-). By comparing the probability values, the significance value of the post-test bleep test results of the experimental group and the control group was obtained, the probability value of 0.000 <0.05 means Ho is rejected and Ha is accepted.

Testing was also conducted before and after giving treatment to the experimental group using the Paired Sample T-test. The t-table values were obtained with df (6) = 1.943 while the t-count of the athlete's bleep test results was 3.992, t-count (3.992) > t-table (1.943) so that Ho was rejected and Ha was accepted without looking at positive (+) or negative (-). Meanwhile, by comparing the probability values, the significance value of the bleep test post-test results of the experimental group and the control group was obtained, the probability value of 0.007 <0.05 means Ho is rejected and Ha is accepted.

So based on the independent sample t-test and paired sample t-test that have been conducted, it can be concluded that there is an effect of vitamin C administration on cardiorespiratory endurance in UNM hockey athletes. In the calculation of the comparison between the VO2Max results of the

experimental group after and before being given vitamin C. The results of the hypothesis testing were carried out in two ways, namely comparing t-table and t-count and comparing probability values.

Based on the results of data analysis that showed an increase after being given vitamin C to UNM Hockey athletes. For hypothesis testing, it is necessary to study further by providing an interpretation of the relationship between the results achieved and the theory underlying the research. This explanation is needed so that the suitability of the theories put forward with the research results obtained can be known where there is an effect of vitamin C on cardiorespiratory endurance in Hockey athletes at the Faculty of Sport Sciences, Makassar State University. The results obtained when associated with the framework of thought and the underlying theories, basically these results are supported by the underlying theory. The results of this study are in line with the research of Sri Suwarsih (2011) entitled "The Effect of Giving Iron Supplements and Vitamin C on Aerobic Endurance and Hemoglobin Levels" which states that giving vitamin C can increase iron absorption so that iron in the blood increases which will increase haemoglobin synthesis, the oxygen transported becomes greater which ultimately increases aerobic endurance. Based on the similarity of aerobic endurance and cardiorespiratory endurance. In other studies, it has been shown that vitamin C deficiency can result in decreased endurance and weakened muscle contractions and fatigue can occur (Halimah, 2014). So based on the discussion above, the results of this study show that there is a significant effect of vitamin C administration on cardiorespiratory endurance in UNM hockey athletes.

## D. Conclusion

Based on the results of data analysis and discussion and several other research results and studies, it can be concluded that there is an effect of vitamin C administration on cardiorespiratory endurance in UNM Hockey athletes. This is because there is a significant difference in the results of the VO2Max cardiorespiratory endurance test of the experimental group given vitamin C in athletes with the control group not given vitamin C. It can be seen in the hypothesis testing that the probability value is smaller than 0.05.

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