THE EFFECTS OF SHAVING ON THE SPEED OF ELITE MALE SWIMMERS

By

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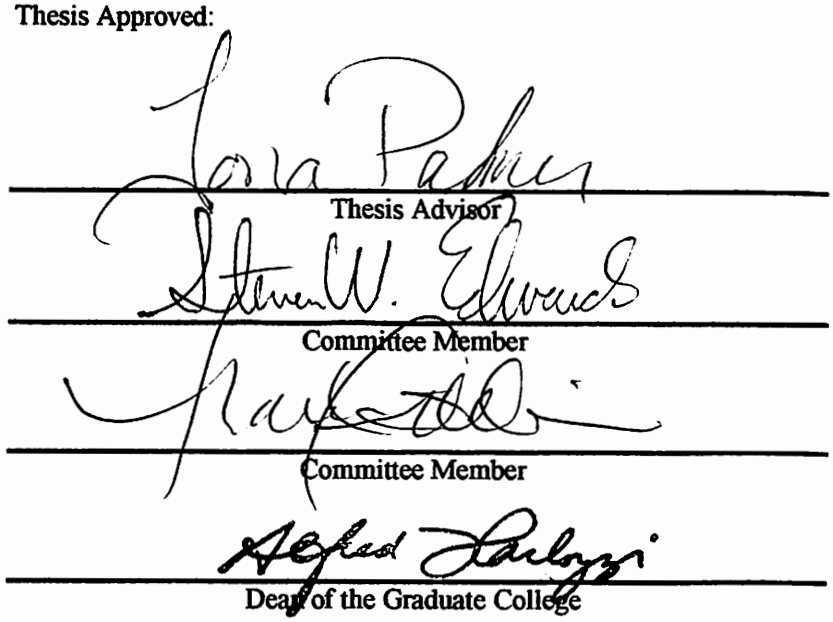

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CHAPTER I

INTRODUCTION

Athletes in every sport are constantly trying to gain the advantage over their opponent. In some cases the opponent could be time or even themselves. The use of an ergogenic aid increases the chance of this occurring. The term ergogenic aid is defined as something having the ability to increase work, especially to increase the potential for work output (Taber's Dictionary, 1997). Common ergogenic aids would include anabolic steroids, creatine phosphate supplementation, swim suit improvements, amphetamines, caffeine or anything else considered to enhance an athlete's performance (Physiology of Exercise, 1994). Some of the above listed ergogenic aids are banned by governing bodies for sporting venues like the National Collegiate Athletic Association (NCAA), the United States Olympic Committee (USOC), and or the National High School Coaches Association (NHSCA). The main governing body for swimming is the Federation International de Notation Amateur (FINA) (Sporting Goods Business, 2000).

Today's most popular ergogenic aid is creatine (Nutrition Forum, 1998). The intake of creatine phosphate is currently deemed legal and not banned by any of the governing bodies for sport. Creatine was introduced as a potential ergogenic aid in 1993 and its use is prevalent in high school, college, professional athletic programs, and the Olympics (Nutrition Forum, 1998). Creatine is claimed to increase energy, muscular strength, produce greater and faster muscle gains, improve performance, delay fatigue, and aid in burning fat (Nutrition Forum, 1998). Research has suggested that creatine may have a future as an ergogenic aid. In several studies, subjects taking creatine have demonstrated significant improvement in short bouts of activities that require both power

and strength such as sprinting, knee extensions, and bench press exercises (Nutrition Forum, 1998). The only documented side effect of creatine supplementation appears to be weight gain (The Physician and Sports Medicine, 1998). In swimming, that side effect of weight gain and therefore being slowed down; far outweighs the possible benefit of increasing the muscular output and performance. Swimming is either a single sprinting event or an aerobic endurance activity, and neither of these described events has been shown to be positively affected by the use of creatine supplementation (Nutrition Reviews, 1999). The search for legal and non-harmful ergogenic aids that still provide some benefit for competitive swimming is on-going.

There have been combined efforts from the entire swimming world to help athletes produce faster results. These changes have been in the areas of swimming pool design, swim suit improvements, training techniques, water temperature and consistency (The Science of the Summer Games, 1996). Kinetically efficient sports like cycling, running, and especially swimming have resorted to shaving part or all of the exposed body hair in order to reduce the wind or water drag and decrease the athlete's performance times (Triathlete, 1987). This is seen at all levels from high school up to the Olympics. Australian Jon Hendricks, in 1955, was one of the first reported world-class swimmers to shave. Currently, this practice is somewhat common in the sport of swimming since the vast majority of swimmers achieve his or her best times when they shave (Swimming Faster, 1982; Forbes Carlisle on Swimming, 1965; The Science of the Summer Games, 1996). It should be pointed out; however, a swimmer will rarely shave for a competition unless he or she has also "tapered" (Illinois Journal of Leisure & Physical Education, 1988).

The usual way to utilize the technique of shaving to increase performance is to train all year while letting the hair grow. Therefore, if an athlete has more body hair naturally than his or her competitor before they shave, the benefit they receive from shaving will be greater. It serves as increased drag and it is like having weights on while training (Illinois Journal of Leisure & Physical Education, 1988). Then before the final race, (state championship, NCAA national championships, or the Olympics) the athlete shaves his or her entire body of any exposed hair. This means legs, arms, back, facial hair, and chest will be "shaved down". Therefore it serves as a natural ergogenic aid that is non-intrusive and legal.

Hair on the body traps air which impedes the water from flowing smoothly over the swimmer's surface (Swimming Technique, 1975). The theory of why shaving improves performance by the athlete "feeling the water" better is strengthened by the idea that these air bubbles interfere with the signal received by the pressure sensing nerves in the skin (Swimming Faster, 1982). Hair also absorbs almost 15 times its weight in water (Science World, 2000). This is added weight theoretically slows the swimmer down.

Some coaches and skeptics believe that this process of shaving has no physical effect on the athletes. One popular theory claims that any benefits derived from shaving are purely psychological in nature (Triathlete, 1987). When shaved, the swimmer can concentrate or focus better on the upcoming meet (Triathlete, 1987). The swimmer is confident because he or she feels that nothing has been left to chance in the final preparation for the big race (Triathlete, 1987). It could be just a mental edge that the shaved athlete possesses over the others. They could "feel the water" better and therefore think that they are going faster. It could also be just a crazy, team bonding ritual and

nothing else.

Tapering is a training technique employed by athletes to reduce their training intensity before a competition in order to improve their ability to give a maximal effort and ensure they are well rested (Illinois Journal of Leisure & Physical Education, 1988). Tapering is defined as to make something smaller in size or amount, especially gradually (Encarta Dictionary, 2004). This means the athlete would begin to reduce the workout distances and intensities up to three weeks prior to the final competition. A gradual reduction each week allows the body to recover from the season long training regimen in order to produce the most maximal effort possible (The Science of the Summer Games, 1996).

Efforts utilized to reduce excess waves and resistance in the pools have resulted in placing contoured gutters around the edge of the pool, which dampen out wave action, and by dividing the competition lanes with finlike disks or perforated floating cylinders. Another change to the swimming pools has been to make them especially deep to reduce speed killing turbulence (U.S. News and World Report, 2000). The net result is a "faster" pool (The Science of the Summer Games, 1996). The temperature also figures into the formula for faster times. The viscosity of water goes down approximately 12% for every 10 Fahrenheit degrees the temperature increases (The Science of the Summer Games, 1996). This means that as the water temperature increases it becomes thicker. It is easier to perform well in a more viscous fluid. The human body has a small range in temperature that it can function properly, especially at a maximal effort. The human body does not perform well when the water temperature drops below 75 degrees Fahrenheit (Forbes Carlisle on Swimming, 1965). If the body remains too warm for long

periods of time then in becomes overheated. Once the water temperature gets warmer than 85 degrees Fahrenheit, the occurrence of heatstroke is highly likely (The Science of the Summer Games, 1996). As a result, competition pools worldwide are now kept between 78 and 82 degrees Fahrenheit (The Science of the Summer Games, 1996).

It is assumed that shaving reduces drag, therefore increasing speed and reducing performance time. Drag in this case is defined as frictional drag. Frictional drag is reduced by a smooth surface. This is probably the most important reason that swimmers have adopted shaving the hair from their bodies before important races (Swimming Faster, 1982). Drag is defined as a resistance to motion; the resistance experienced by a body moving through a fluid medium (Encarta Dictionary, 2004). On a large scale, some would argue that if you removed the entire body hair from a male human that the resulting hair loss would not amount to much more than a small ball with insignificant weight and the loss of that would not cause the improvements in speed. As a whole, the male human is not considered overly hairy as compared to aquatic animals. The best way to picture the effect of eliminating the body hair would be to imagine a water flume cycling water over a surface of three square inches with hair follicles on it and being able to visualize the disturbance. The wave disturbances in water flow would be quite significant at this small scale level. Then take the same flume with water flowing over a smooth surface and being able to notice the difference. The difference at this minimal level would be apparent. Take that effect and multiply it by the rest of the remaining human skin and the overall effect would make sense.

Another option has been developed in the search to decrease frictional drag in swimming. That search resulted in the discovery of a new style of swimsuit called the

Fastskin made by Speedo. This new suit mimics sharkskin in that it contains tiny V-shaped ridges that allow water to pass over the swimmer more efficiently. The super stretch fabric also compresses a swimmer's muscles, reducing vibration in the tissue and therefore reducing the buildup of lactic acid that causes fatigue (New York Times, 2000). Like any swimmer, a shark fights drag, a slowing force caused by friction. To reduce drag between its body and the water, a shark's skin is covered with toothlike scales, called denudes. As the shark swims, water rubs only against the tiny tips. Since there is less friction on smaller surfaces, there is less drag than if the shark's skin were smooth (Science World, 2004).

During the literature review other questions are raised about the swimming research done by the Eastern block countries. Why would the East German swim team not shave for the 1988 Summer Olympics? With as much emphasis that they put on winning, wouldn't they do anything within the rules to enhance their performance? Do they know something that we do not know?

Statement of the Problem

The purpose of the research is to test the effect that shaving the body hair has on the speed of the elite male swimmer. A review of literature on the topic of elite male swimmers shaving produced only a handful of articles. Furthermore, these articles were inconsistent and non-research based. A study is needed to determine if shaving has a statistically significant affect on race time.

Hypothesis Statement

Ho= The null hypothesis is that there is no difference in times between the shaved and non-shaved groups in any of the events tested.

Significance

The importance of this research has impacts from the individual level all the way up to the overall sport level. This research either dispels the myth of this ergogenic practice or solidifies the theory that this method works to increase a swimmer's performance.

Limitations

1. The subjects were male high school swimmers that qualified for the state championship meet.
2. The strokes used in the competition were the front crawl, (which is considered the fastest stroke for the freestyle event), butterfly, backstroke, breaststroke, and a combination of those for the medley.
3. The swimming pool used for the competition was 25 yards in length. It was the Oklahoma City Community College's pool.

Delimitations

1. The sample population consisted of high school male athletes with the age ranging from 14-19 years of age.
2. The study was limited to swimmers who met the standards to qualify for the Oklahoma High School state championship meet.

Basic Assumptions

1. Since the males wore similar swimming suits and swimming hats, it was assumed that the amount of drag created by each of these articles was the same.

2. It was assumed that the subject's information that was used was an adequate representation of high school elite male swimmers.
3. Because of the nature of the investigation, the investigator was satisfied that all the subjects gave a maximal effort.

Operational and Functional Definitions

Backstroke-Swimming on the back: a method of swimming on the back in which the swimmer makes circular backward movements with each arm alternately while kicking the legs rhythmically up and down (Encarta, 2004).

Breaststroke-A swimming stroke in which the arms are extended and pulled back together in a circular motion while the legs are thrust out and pulled together (Encarta, 2004).

Butterfly-A swimming stroke in which both arms are lifted simultaneously above and over the head while both the feet are kicked up and down (Encarta, 2004).

Elite-Someone who has attained the highest status in their field as defined by his or her competition standards (Physiology of Exercise, 1994). The elite male swimmer as classified by the researcher will be any male that has qualified for the Oklahoma Secondary School Activities Association (OSSAA) Swimming State Championships in 2004.

Ergogenic Aid-An enabling action, device, or substance used in order to increase performance (Physiology of Exercise, 1994; Taber's Dictionary, 1997).

Form Drag-Resistance caused by the shape of the body (New York Times, 2004).

Freestyle-Used to describe a swimming contest in which the competitors use the fastest swimming stroke, the front crawl stroke (Encarta, 2004).

Frictional Drag-1.-Resistance created by a body as it moves through a fluid medium (Encarta, 2004). 2.-Drag caused by molecules brushing against the body (New York Times, 2004).

Non-intrusive/invasive-Not penetrating the skin or mucous membranes of the human body (Taber's Dictionary, 1997).

Medley-The swimmer uses different strokes for different laps in the race (Encarta, 2004).

Novice-Someone who is not very experienced in a particular field (Physiology of Exercise, 1994).

Taper-A gradual reduction of training intensity in preparation for a championship competition that may last anywhere begin 1 to 3 weeks prior to that meet (Illinois Journal of Leisure & Physical Education, 1988).

Water Viscosity-The property of a fluid or semi-fluid that causes it to resist flowing. This is how thick a fluid is. High viscosity equals easy, fast fluid movement; low viscosity equals slow, thick fluid movement (The Science of the Summer Games, 1996).

Wave Drag-The wake that the swimmer creates and must swim through (New York Times, 2004).

Note - operational and functional definitions are defined by the researcher as how they relate to this study

CHAPTER II

REVIEW OF THE LITERATURE

The literature relating to the effects of shaving on a swimmer's time is limited. When searching for compelling, supporting material, only short pieces and statements were found. The search was unable to locate statistical research supporting or dispelling the concept of shaving to improve performance. For many years the practice of shaving was thought to be speculation and guessing done by coaches and athletes alike, but an article helped to support the theory that "body shaving has been scientifically shown to gain the fastest male swimmers up to a full second over 100 meters" (Popular Science, 1996).

Creatine Supplementation and Erythropoietin (EPO)

Improvement of performance is what the competitive athlete is in constant search of, in most cases the athlete will do whatever it takes to gain an advantage whether it is deemed legal and or ethical (US News & World Report, 1996). One of the topics currently under review is the use of creatine supplementation as an ergogenic aid. Creatine was introduced as a potential ergogenic aid in 1993 (Nutrition Forum, 1998). During quick bursts of activity, creatine plays a role in energy production. When muscles contract, adenosine triphosphate (ATP) is used to fuel the movement. A muscle has only enough ATP stored to perform high-intensity muscle contractions for about ten seconds (Nutrition Forum, 1998). For the energy system to continue, more ATP must be produced. The ability to regenerate ATP depends on the supply of creatine phosphate in the muscles. There is no Recommended Dietary Allowance (RDA) for creatine, but one to two grams per day is what researchers have estimated as the daily requirement.

Typically, about one gram per day is made by the body, and one gram per day is consumed in the diet (Nutrition Forum, 1998). According to current theory, creatine supplementation increases the bio-availability of creatine phosphate in the skeletal muscle cells. This increase is believed to enhance muscle performance by allowing faster re-synthesis of ATP to provide energy for brief, high-intensity activities and by buffering the intra-cellular hydrogen ions that are associated with lactate production and muscle fatigue (Nutrition Forum, 1998). So it's thought that creatine's ergogenic effect may be to increase the force of muscular contraction and prolong anaerobic exercise. Studies also show that creatine supplementation may lead to an increase in body mass. This ergogenic aid seems to benefit activities such as power lifting, bodybuilding, football, and track & field events like shot put, discus, and javelin (Nutrition Forum, 1998). There is no evidence that creatine supplementation can enhance endurance-exercise performance, such as long-distance running, cycling, or swimming. In fact, the weight gain associated with supplementation may actually have an adverse effect on such endurance activities (Nutrition Forum, 1998). The International Olympic Committee (IOC) does not include creatine on its list of banned substances because creatine is a dietary component and it would be difficult to determine who might be taking creatine supplements and who might be eating large amounts of meat (Nutrition Forum, 1998).

Another aspect that is evolving in the search to improve performance is genetic development. A currently banned substance is the drug erythropoietin (EPO) (www.ncaa.org). This drug increases red blood cell production, thus improving stamina and oxygen carrying capacity (Physiology of Exercise, 1994). This drug has the same effect of blood doping. Blood doping is where an athlete would have their blood drawn

out and their red blood cells frozen and saved. At a later time after the body has produced new red blood cells, the frozen ones are thawed out and injected into the circulatory system to give the body an extra oxygen carrying capacity (Physiology of Exercises, 1994). New research, however, will soon make it possible for athletes, and everyone else, to improve their genes. Athletes in the near future will be able to inject a gene that increases red blood cell production like EPO and the "genetic cheating" will be almost impossible to test for (U.S. News & World Report, 2000).

Shaving

In swimming, the practice of eliminating all of the athlete's body hair follicles and dead skin cells, also known as "shaving down", has become standard practice in order to reduce drag and shave seconds off of the athlete's race time (US Weekly, 2000). Swimmers often report four subjective sensations following shaving (Swimming Technique, 1975). The first is a feeling of a considerable decrease in body mass and water resistance. A second is an increase in buoyancy. A third is a feeling that the body has been lubricated and he or she will not stop once momentum has been gained. The fourth is the swimmer's feeling that it is much easier to swim. Men and women shave just about their entire bodies (heads usually excluded for vanity) before a competition to minimize the resistance between skin and water (U.S. News & World Report, 1996).

With the limited previous studies on this subject of shaving, it is still widely practiced and believed to be beneficial by most of those involved in the sport of swimming. In most of the literature reviewed for the topic, the consensus was that shaving the hair off of the body reduced resistance and increases their performance by making it easier to slide through the water (Forbes Carlisle on Swimming, 1965; New

York Times Magazine, 2001; Swimming Faster, 1982; Swimming Technique, 1975; Triathlete, 1987). These articles are backed by research done by Dr. Rick Sharp in 1988 & 1989. His methods for the 1988 work included testing the freestyle stroke and measuring the physiological cost as compared to being shaved or not. The conclusion that resulted from that work is that shaving the body hair prior to swimming reduced the swimmer's time. The number of participants was 18 and the alpha level was .05. The 1989 work focused the physiological responses that are influenced by removing body hair has during breaststroke swimming. The number of participants in that study was 22 and the alpha level was also set at .05. The fact that eliminating the body hair helped reduce their swimming times was a result but not a direct hypothesis in either of these studies.

Fastskin Swimsuits

Some sports that require low drag, or resistance, and fast speeds in order to perform successfully have concentrated on different materials to improve that ratio. Attempts to increase performance have resulted in companies developing swimsuits made out of a new material. These suits are made of densely woven synthetic micro fibers which are said to have even lower drag than human skin (Popular Science, 1996). The most widely used model of the body suit is made by Speedo, the official supplier of the United States swim team (New York Times, 2000). It is called the Fastskin suit, which mimics sharkskin in that it contains tiny V-shaped ridges that allow water to pass over the swimmer more efficiently. The super-stretch fabric also compresses a swimmer's muscles, reducing vibration in the tissue and therefore reducing the buildup of lactic acid that causes fatigue (New York Times, 2000). Speedo makes different versions of the Fastskin suit to accommodate for different swimming strokes. There is a sleeveless

version for breaststroke and backstroke swimmers. A racing tank for women and a racing brief also are part of the line. Different suits vary slightly in where certain stretch materials are positioned to allow for minimal resistance during the swimming stroke. The material used is a combination of Lycra and polyester "super stretch" fabric (Time, 2000). There also exists, for the first time, male and female specific suits (Mechanical Engineering, 2004). Each suit for the Olympic swim team is custom fitted to accommodate for each person's specific body contour using a 3-D scanner (Morning Edition, 2000). The full body suit is the most hydrodynamic and runs about $250 full retail (Sporting Goods Business, 2000).

Effects

Swimmers generally try to reduce frictional drag by shaving the hair off their body. Because the water is so dense, swimmers expend more than 90% of their energy just trying to overcome fluid resistance (New York Times, 2004). Many swimmers shave their whole bodies the night before a meet, to better feel the water (Triathlon, 1984). Stanford University swimming coach Skip Kenney estimates that shavers get a two percent speed boost (Wall Street Journal, 2001). This inexpensive, non-intrusive, legal ergogenic aid is widely practiced by elite and novice athletes alike (US Weekly, 2000). Not only has it been shown to improve raw speed, it could provide a mental edge for an athlete. Sometimes before a meet, the entire team will get together and shave their entire bodies. This is usually done the night before the meet because the meets are held early in the morning and that time needs to be focused on warm-up, stretching, and mental preparation (New York Times Magazine, 2001). There is a notice on the OSSAA's website stating that shaving on-site is prohibited at the aquatic center to prevent possible

blood borne infectious disease transmission (www.ossaa.com, 2004).

Summary

In the articles referenced, the concept of shaving and its benefits were the same. No actual statistical research studies were located except Dr. Sharp's studies back in 1988 & 1989. Even if shaving does not physically reduce an athlete's time, they could improve his or her performance because they "feel the water" better or the ritual could merely serve as a good team bonding activity. Other team bonding rituals include everyone on the team dying their hair blonde, wearing certain superstitious pieces of clothing all season long. Some athletes might not wash certain articles like socks or underwear if they appear to be on a winning streak (U.S. Weekly, 2000). The psychological aspects of any sport are almost as important as the physical ones (New York Times, 2004). If someone "feels" that they are faster, more times than not, they will perform better. The articles reviewed state that shaving reduces the elite athlete's time by up to one second for the 100 meter distance (Popular Science, 1996). What was not clearly stated though is if that effect compounds with longer distances or does the effect reduce and have no impact with longer races. Another issue is whether shaving is good for some events but not as effective for other ones. In principle, one would think that shaving might have an effect in certain speed races and the freestyle events but form and technique would have a larger impact on events like the breaststroke, backstroke, and butterfly.

CHAPTER III

METHODOLOGY

Subjects

The male swimmers that qualified for the Oklahoma High School Swimming State Championship had their times utilized as data in the study. These athletes ranged in age from 14 to 19 years old. These race times are public knowledge as posted on the Oklahoma Secondary School Activities Association's website.

Methods

The process of gathering data began March 29, 2004. The coaches were faxed an inquiry form so they could identify the athletes/subjects that shaved prior to the state meet, a consent form giving them permission to release the requested information to the primary researcher, and an informed consent for the athletes/subjects to sign; or their parents if they were minors. The athletes that shaved were utilized as the experimental group in this study. The athletes either chose to shave on their own or were requested to shave by their coaches. The shaving group eliminated all body hair excluding what was covered by the swim suit, swim cap and their eyebrows. The athlete's that did not shave for this state meet will be the control group in this research. Once it was determined who shaved or not they were placed into either the control group or the experimental group. Each athlete had a random number assigned to them for the purpose of the study. This random number was the only identifying mark for the subjects. Being held constant was training, tapering, and amount of body hair that remained. The pre-test times used in this study were the lowest time recorded for the same event that each subject swam throughout the season. The post-test data used in this study was the fastest race time

produced at the state meet whether that was finals or prelims that each athlete swam without fault, injury, or withdrawing. The archival data that was used was collected by the primary researcher from the OSSAA's website that is public knowledge. On the website, the researcher had access to the previous top times before the state swim meet and all of the state swim meet results. The race time data was recorded by the electronic computer used for the official results. If any subject happened to obtain any type of injury or cramping during their event, their data was disregarded for the study.

Analysis

The testing attempted to eliminate any outside factors that would adjust the resulting times. Since the primary researcher used archival data that was produced in February 2004, there were no associated or assumed risks for this study. Only the researcher and the committee had access to the data and any other identifying material. The pre-test and post-test data was compared within the eight different events to determine if shaving had a significant affect of the race times. The events tested included the 50 yard freestyle, 100 yard freestyle, 100 yard butterfly, 100 yard breaststroke, 100 yard backstroke, 200 yard individual medley, 200 yard freestyle, and the 500 yard freestyle. The researcher used a paired t-test to determine if there were any significant differences for each distance. The significance level was .05. The analysis that was used was an ANOVA. The results are available upon request to all the subjects and coaches so they can use the information to determine whether they want to utilize shaving for their future competitions.

CHAPTER IV

RESULTS

This investigation was based on the theory that reducing the overall frictional drag by shaving the body hair would reduce the elite male's swimming race times. The research had an alpha level set at .05 and the null hypothesis stated there is no difference in times between the shaved and non-shaved groups in any of the events tested. There was a modification in the methods of this research due to the unexpected return response in data. The athletes that shaved were the only group that had their data returned to the researcher and therefore it was the only data that was able to be analyzed. The return rate was 70% since 158 athletes out of 224 participants returned the requested information. The primary researcher could not assume that any unspecified athlete either shaved or not so their data sets were eliminated from the data pool. Some of the elite athletes, especially in the 100 yard freestyle, did not shave because this race was not their final race of the year. Several of the top finishers of the 100 yard freestyle were continuing on to the Olympic qualifiers. So therefore, even though they reduced their swimming times, they did not shave and their data might have affected the statistical outcome of the 100 yard freestyle event.

General Subject Characteristics

The subject characteristics were high school male athletes ranging from 14-19 years of age from the state of Oklahoma. For this investigation, each event was analyzed separately. Event analysis is posted in Table 1 on page 20-21. There were a total of eight different events. Some of the athletes swam in multiple events. The events and number of participants were as listed below:

Event 1 - 100 yard butterfly: N=17
Event 2 - 50 yard freestyle: N=28
Event 3 - 100 yard backstroke: N=17
Event 4 - 100 yard breaststroke: N=20
Event 5 - 100 yard freestyle: N=19
Event 6 - 200 yard freestyle: N=18
Event 7 - 200 yard individual medley: N=19
Event 8 - 500 yard freestyle: N=20
Total: N=158
Total number of athlete's in the state meet = 224

Summary of Results

All of the events evaluated post-shave produced a statistically significant reduction in time except for event five, which was the 100 yard freestyle. That one event becomes statistically significant if the confidence level is changed from 95% to 93%. This dispels the stated hypothesis for this research and the researcher would have to reject it. A more relevant statement for this investigation would be that shaving the body hair from the elite male swimmer aids in reducing swim time in every event, except the 100 yard freestyle event.

Table 1

Event 1	100 yard butterfly		N=17
Mean (shaved)	58.891 sec	Standard Deviation (shaved)	3.682
Mean (unshaved)	59.808 sec	Standard Deviation (unshaved)	3.529
Significance	.032	Statistically Reduced?	YES
Event 2	50 yard freestyle		N=28
Mean (shaved)	23.655 sec	Standard Deviation (shaved)	.760
Mean (unshaved)	23.901 sec	Standard Deviation (unshaved)	.704
Significance	.005	Statistically Reduced?	YES
Event 3	100 yard backstroke		N=17
Mean (shaved)	58.037 sec	Standard Deviation (shaved)	3.781
Mean (unshaved)	59.316 sec	Standard Deviation (unshaved)	2.996
Significance	.002	Statistically Reduced?	YES
Event 4	100 yard breaststroke		N=20
Mean (shaved)	66.342 sec	Standard Deviation (shaved)	3.318
Mean (unshaved)	67.243 sec	Standard Deviation (unshaved)	2.798
Significance	.029	Statistically Reduced?	YES
Event 5	100 yard freestyle		N=19
Mean (shaved)	51.400 sec	Standard Deviation (shaved)	2.341
Mean (unshaved)	51.738 sec	Standard Deviation (unshaved)	1.962
Significance	.064	Statistically Reduced?	NO

Event 6	200 yard freestyle		N=18
Mean (shaved)	113.076 sec	Standard Deviation (shaved)	5.515
Mean (unshaved)	114.925 sec	Standard Deviation (unshaved)	4.985
Significance	.004	Statistically Reduced?	YES
Event 7	200 yard individual medley		N=19
Mean (shaved)	129.502 sec	Standard Deviation (shaved)	8.316
Mean (unshaved)	132.547 sec	Standard Deviation (unshaved)	6.877
Significance	.003	Statistically Reduced?	YES
Event 8	500 yard freestyle		N=20
Mean (shaved)	311.724 sec	Standard Deviation (shaved)	13.966
Mean (unshaved)	317.988 sec	Standard Deviation (unshaved)	13.593
Significance	.000	Statistically Reduced?	YES

Explanation of Results

The data and how it was analyzed produced results that show that in seven of the eight events, the swimming times were statistically reduced. The shaved and unshaved times are referring to each athlete's swimming times before they shaved and after they shaved for each event. If the significance number was less than .05 then it was determined to be a statistically significant reduction. The standard deviation is how far the data set varied from the mean in either direction and the mean is the average of the group.

CHAPTER V

DISCUSSION

The purpose of this investigation was to determine if shaving body hair produces a significant reduction in maximal swim times. Values obtained before shaving were compared to those values produced after shaving for each event. A significant reduction in swimming time was expected by the primary researcher at a maximal effort in the 100 meter freestyle and 50 yard freestyle events due to information found in the literature review. Contrary to that early suspicion, a significant reduction was noticed in seven of the eight events with the one exclusion coming very close to being significant. When analyzing the results of this investigation, there were a few significant findings along with some surprising revelations. All of the events evaluated post-shave produced a statistically significant reduction in time except for event five, which was the 100 yard freestyle. That one event becomes statistically significant if the confidence level is changed from 95% to 93%. That was an unexpected result from the preliminary evaluation of the data. The expected result was that shaving reduced the time significantly in the 50 yard freestyle and the 100 yard freestyle. All of the rest of the improvements were expected to be from form, technique and tapering for the backstroke, breaststroke, butterfly stroke, the medley, and the longer freestyle events. This dispels the stated hypothesis for this research and the researcher would have to reject it. A more relevant statement for this investigation would be that shaving the body hair from the elite male swimmer aids in reducing swim time in every event, except the 100 yard freestyle event. This event probably would also have been significant if you are able to include the top finishers and if they had shaved. The researcher acknowledges the fact

that many circumstances come into effect during the state championship swim meet. Some of those being adrenaline, tapering, shaving, psychological factors, rising to meet the level of your competition, and other unknown variables could be the reason for the decrease in times. A combination of several of the above listed factors probably had an effect on reducing race times during the state swim meet.

Swimming Times

The fact the subject's times that were used in this study produced significantly lower data ($p>0.05$) after shaving, except for one event, is reason enough for the majority of the swimming coaching community to continue encouraging their athlete's to shave. The majority of the athlete's that participated in this study reduced their post-shave swim times. A small percentage of the athlete's that did not improve their swim times had some reasons why. A couple of coaches explained the decline and said it was due to the fact that certain athlete's did not even show up for practice the last two weeks prior to the swim meet, some of them didn't taper because this wasn't their final meet, and finally several of the athlete's just tried hard enough and were satisfied in only making the state swim meet. The percent decrease in time can equal a savings of tenths of a second in the 50 yard freestyle or several seconds in longer events. This reduction can be the difference in placing 1st or 15th in elite events like the Olympics or NCAA championships. When the reductions in swimming time found in this investigation are compared to those found in Dr. Sharp's first study in 1988, they compare favorably, although Dr. Sharp used only a distance of 200 yards instead of the multiple events used in this investigation.

Significance of Findings

The bottom line is that the subjects swam faster after they shaved. For the swim coach, the investigator recognizes this research finding as a useful tool in convincing a reluctant swimmer (and his/her parents) that shaving can help him or her to swim faster. It should also be noted that tapering and proper training are necessary to complete this process before a major competition. Other outside factors like psychological mood state, amount of adrenaline flowing through an athlete's cardiovascular and endocrine systems, mental preparation and season long training and tapering have an effect on the result that swimming times reduced at the state meet. This reduction cannot be contributed to shaving alone.

Null Hypothesis

There is no difference in times between the shaved and non-shaved groups in any of the events tested.

1. Results of the study indicated a significant reduction at the 0.05 level of significance in times in all but one of the events tested.
2. There was no non-shaved group.

Therefore the null hypothesis was rejected.

Concluding Remarks

There is a possibility that psychological effects may have played a role in the observed reduction in time but that outside factor was beyond the control of the investigator. Many questions remain concerning shaving. Among these is the question of when to shave before an event? Does how fast someone's hair grows back matter for when they shave? What is the psychological effect of shaving? The fact that the

overwhelming majority of swimmers express how much better they feel in the water after shaving leads the investigator to question how much of a role this plays in post-shaving swimming performance.

Undoubtedly, more research is needed in this area before these and many more questions can be answered.

Recommendations

1. Follow up with research consisting of using a small water flume and a measuring instrument that is able to detect the wave disturbances in shaved and unshaved surfaces at a small scale level. When someone is able to figure the disturbance over a three by three square inch region and then multiply it by the surface area of a human swimmer, the significance should be apparent.
2. Further studies may consider a repeat of a similar study in multiple states to have a larger comparison group.
3. Further studies might hope for a larger return rate.
4. Further studies may consider a repeat of a similar study in the same state in following years to track certain athletes for up to four consecutive years to note their history.
5. Have two groups so one can operate as the control and one can be the experimental.

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APPENDIX A

AGREEMENT TO PARTICIPATE

IN RESEARCH FOR ATHLETE

THE EFFECTS OF SHAVING ON THE SPEED OF ELITE MALE SWIMMERS

Agreement to participate in Research

Authorization

I, (participant)_____, hereby authorize or direct Robert Woods, or associates or assistants of his choosing, to perform the following procedure. The data collected during this study will be used by the above listed to fulfill the requirements necessary for the completion of a master's program of study in the Health and Human Performance Program at Oklahoma State University in Stillwater, Oklahoma.

Description of research and associated risks/benefits

1. This study involves researching the effect that shaving before a swimming competition has on performance. It is being conducted through Oklahoma State University by Robert Woods, who is a graduate student in the Health and Human Performance Department at OSU.
2. The purpose of this study is to see if the lack of body hair on elite male swimmers reduces their time in the 50 yard freestyle, 100 yard freestyle, 100 yard butterfly, 100 yard backstroke, 100 yard breaststroke, 200 yard individual medley, 200 yard freestyle, and 500 yard freestyle events. The duration of the subjects' participation will be however long it takes to swim the events.
3. The data being used in this study is archival in nature. Being used for the pre-test is the most recent swim times and the post-test data will be the final race of the season for each swimmer whether it be the finals or the prelims. What the researcher is asking consent for is whether or not the athlete shaved his body hair prior to competing in the state competition.
4. The athletes will be put into two groups according to who has shaved or not. Then we will record the data and compare the differences, if any, in speed between the pre-test and post-test times.
5. There are no risks associated with this research since the researcher will be using archival data.
6. Once the athlete has competed, they will be given a random number from 1-230. That is how they will be tracked and information kept confidential. Access to that information will be restricted to the researcher and the research committee chair.
7. All identifying material will be stored separately from data and destroyed by the researcher following the satisfactory completion of the master's degree. Only the primary researcher and the committee chair will have access to this data.

Robert Woods
824 W Bennett Dr. Stillwater, OK 74075
Oklahoma State University
(405) 744-6652

Questions, concerns, or complaints about the research or subject's rights should be directed to Dr. Carol Olson, IRB Chair, Oklahoma State University, 415 Whitehurst, Stillwater, OK 74078, (405) 744-1676

Voluntary Participation

I understand that participation is voluntary and that I will not be penalized if I choose not to participate. I also understand I am few to withdraw my consent and end my participation in this project at any time without penalty after I notify the project directors Robert Woods at (405) 744-6652.

Consent documentation for written informed consent

I have read and fully understand the consent form. I sign it freely and voluntarily. A copy has been given to me.

Date _____ Time _____am/pm

Participant Name (print) _____(signed) _____

Person authorized to sign if
participant is a minor (print) _____(signed)_____

I certify that I have explained all elements of this form to the subject or his representative before requesting the subject or his representative to sign it.

(signed) _____
Robert Woods
Project director

Please fax this completed form back to Robert Woods
at the fax number (405) 744-3785.

APPENDIX B

PHONE CONTACT INQUIRY

THE EFFECTS OF SHAVING ON THE SPEED OF ELITE MALE SWIMMERS

Robert Woods
Contact Inquiry for Research
Oklahoma State University
April 2004

High school coach:

Hello my name is Robert Woods I am a graduate student working on my master's degree at Oklahoma State University. I am conducting some research dealing with shaving and swimming. I have a couple of questions regarding your male swimmers. Do you have time to answer them?

1. How many male swimmers did you have in the state meet? _____
2. Did you require them to shave before the state meet? Yes or No
3. How many of them shaved their body before the state meet? _____
4. Which athletes shaved prior to the state meet?

1._____	8._____
2._____	9._____
3._____	10._____
4._____	11._____
5._____	12._____
6._____	13._____
7._____	14._____

Please return this completed form to Robert Woods at fax number (405) 744-3785.

APPENDIX C

AGREEMENT TO PARTICIPATE

IN RESEARCH FOR COACH

THE EFFECTS OF SHAVING ON THE SPEED OF ELITE MALE SWIMMERS

Robert Woods
Informed Consent for Research
Oklahoma State University
April 2004

Informed consent of high school coach:

Date_____

I, _____, the head swim coach at _____ give my consent to provide the primary researcher for this research project the requested information about the male athletes. The information being requested is whether or not the male athletes shaved his body hair prior to the state swim meet on February 27th and 28th, 2004. I understand that there will be no identifying marks with the school, the athlete and the school's name, and the athlete's name. The above listed items will not be used in reporting the results of this study. The primary researcher for this project is Robert Woods. He is a graduate student working to complete his master's degree at Oklahoma State University.

(coach) X_____

Please return the signed forms to Rob Woods at fax number (405) 744-3785.

APPENDIX D

AGREEMENT TO ALLOW RESEARCH

FOR SENIOR ADMINISTRATOR

THE EFFECTS OF SHAVING ON THE SPEED OF ELITE MALE SWIMMERS

April 2nd, 2004

Oklahoma State University

Approval to conduct research at satellite facilities

Research Proposal Title: The Effects of Shaving on the Speed of Elite Male Swimmers

To Whom It May Concern:

This letter is to explain the proposed research to be conducted at your satellite facility and obtain permission to receive the requested information. Your swim coach/sponsor has been faxed an informed consent for the athlete/subject to provide permission for the coach/sponsor to inform the primary researcher whether or not the athlete/subject shaved his body hair prior to the state swim meet that was held on February 27th and 28th. The swim coach/sponsor has also received an informed consent that would give his or her permission to pass that information on to the primary researcher. The swim coach/sponsor has also received an inquiry form that allows them space to write which athlete/subject did or did not shave and contains a few questions about how many athletes shaved prior to the state meet and how many participated in the state meet.

What the primary researcher is requesting is your permission to conduct research by obtaining whether certain male athletes/subjects shaved prior to the state meet so he can compare the pre-state meet times with state meet times to determine if shaving provides a statistically significant difference in race times.

If you have any further questions about the faxed papers please contact your swim coach/sponsor to view those.

If you have any further questions for the primary researcher please feel free to contact him at (405) 744-6652.

If you have any other questions that need to be directed to the Institutional Review Board Chair, please feel free to contact her at (405) 744-1676.

Senior Administrator_____ (print)

_____ (signed)

School District _____

Date _____

Thank you,

Robert Woods

Primary Researcher

Please return this form signed to Robert Woods at fax number (405) 744-3785

APPENDIX E

IRB APPROVAL

Oklahoma State University
Institutional Review Board

Protocol Expires: 3/23/2005

Date: Wednesday, March 24, 2004 IRB Application No ED0490

Proposal Title: The Effects of Shaving on the Speed of Elite Male Swimmers

Principal Investigator(s):

Robert Woods
2208 W. 10th St.
Stillwater, OK 74074

Tona Palmer
427 Willard
Stillwater, OK 74078

Reviewed and Processed as: Expedited (Spec Pop)

Approval Status Recommended by Reviewer(s): Approved

Dear P1:

Your IRB application referenced above has been approved for one calendar year. Please make note of the expiration date indicated above. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval.
2. Submit a request for continuation if the study extends beyond the approval period of one calendar year. This continuation must receive RB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of this research; and
4. Notify the RB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the RB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the RB procedures or need any assistance from the Board, please contact me in 415 Whitehurst (phone: 405-744-5700, colson@okstate.edu).

Sincerely,

Carol Olson

Carol Olson, Chair
Institutional Review Board

Oklahoma State University
Institutional Review Board

Protocol Expires: 3/23/2005

Date: Thursday, April 22, 2004 IRB Application No ED0490

Proposal Title: The Effects of Shaving on the Speed of Elite Male Swimmers

Principal Investigator(s):

Robert Woods
2208 W. 10th St.
Stillwater, OK 74074

Tona Palmer
427 Willard
Stillwater, OK 74078

Reviewed and Processed as: Expedited (Spec Pop)

Approval Status Recommended by Reviewer(s): Approved **Modification**

Please note that the protocol expires on the following date which is one year from the date of the approval of the original protocol:

Protocol Expires: 3/23/2005

Signature :

Carol Olson

Carol Olson, Director of University Research Compliance

Thursday, April 22, 2004
Date

Approvals are valid for one calendar year, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

VITA

Robert A. Woods

Candidate for the Degree of

Master of Science

Thesis: THE EFFECTS OF SHAVING ON THE SPEED OF ELITE MALE SWIMMERS

Major Field: Health and Human Performance, Applied Exercise Science

Biographical:

Educational: Received a Bachelor of Science degree in Health and Human Performance from Northeastern State University in May 1994. Completed the requirements for the Master of Science degree in Health and Human Performance with an emphasis in applied exercise science from Oklahoma State University in July 2004.

Experience: Currently employed at Oklahoma State University as a graduate assistant for the men & women track & field and cross country teams, providing medical coverage for both home and away sporting events. Internship at Eastern Oklahoma Orthopedic Center, 1999. Internship at Muskogee Rehabilitation and Sports Medicine Clinic, 1999. Worked at Hillcrest Sports Medicine in Tulsa, OK as a staff head athletic trainer covering two local high schools, July 2000- Oct. 2001. Worked as a restorative therapist for Grove Nursing Center. Worked as an athletic supervisor for Wellness 2000 Incorporated. Worked at Peterson Physical Therapy as a staff athletic trainer covering clinical rotations & head athletic trainer at a local high school. Organized & coordinated an instructional summer camp for athletic training students while at Hillcrest Sports Medicine. Worked as a physician extender to assist with morning sick call at OSU 2002-2004

Accomplishments: NSU-Alpha Chi Honor Society, Rho Theta Sigma Honor Society, highest GPA on athletic training staff, 2nd runner up in Mr. NSU pageant-1998, member of the BIG XII athletic training staff of the year at OSU 2002-2003, member of the Student Athletic Advisory Council (SAAC) NSU 1998-1 999

Professional Memberships: Current first aid, professional rescuer, & Automated External Defibrillator (AED) certifications, OSHA certified, licensed in Oklahoma & certified by the NATABOC as an athletic trainer, member of Oklahoma Athletic Trainer's Association & National Athletic Trainer's Association, Approved Clinical Instructor (ACI)