



Utilization of Used Rubber Bands as Sports Equipment for Skipping Rope

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Abstract

This study explores the potential of reusing discarded rubber bands as an alternative material to create an affordable and environmentally friendly jump rope. The study emphasizes the importance of physical activity, particularly jump rope, for maintaining health and fitness. By utilizing discarded rubber bands, the study aims to address waste reduction and the need for accessible sports equipment. The methodology involves collecting, cleaning, and assembling discarded rubber bands into a functional jump rope. Fitness measurements, including resting heart rate, maximum jumps per minute, and time to exhaustion, were recorded before and after the exercise period. Results showed improvements in all measured parameters: decreased mean resting heart rate (from 72.4 to 68 bpm), increased maximum jumps per minute (from 84.8 to 110), and longer time to exhaustion (from 5.2 to 7.2 minutes). These findings suggest that the rubber band jump rope effectively contributed to the cardiovascular health, stamina, and endurance of the participants. The study concludes that the repurposed rubber band jump rope offers a viable, cost-effective, and environmentally friendly alternative to traditional sports equipment. This innovation has the potential to contribute to environmental sustainability, social inclusivity in fitness, and economic accessibility to sports equipment.

Keywords: Rope skipping, recycled rubber bands, Alternative sports equipment, Recycling, Physical fitness

1. Introduction

Sport is a form of planned and structured physical activity that involves repetitive body movements and is intended to improve physical fitness. Sport is part of the basic needs in everyday life because it can increase a person's endurance. Sport can be started from an early age to old age and can be done every day. Exercising regularly can increase endurance so that the body is not easily attacked by disease (Singh et al., 2022). When exercising, the body will be freer to move. This will trigger the metabolism process and blood circulation to be smoother.

The benefits of exercise are not only for physical health but also mental. To maintain a healthy body, exercise is one of the most practical and simple ways but is often ignored by most people. One form of exercise that is interesting and easy to do is rope jumping (Barrio et al., 2023). This activity is not only fun but also provides various health benefits. Also known as skipping, rope jumping has become a popular sport among various groups, from children to adults. In addition to being a means of recreation, skipping is also effective in helping to maintain body fitness and control weight (Shkola et al., 2022).

The benefits of skipping are to burn calories so that this sport is suitable for losing weight. The jumping movement in skipping sports is good for training the lower body muscles, including the calves and thighs, to be stronger and tighter. In addition, Skipping requires coordination of many parts of the body at the same time so that the brain must also think quickly (Yang et al., 2020). Jumping rope is one of the best cardio sports that is right for heart health and a healthy heart will keep diseases such as stroke and heart attack away.

However, not everyone has access or the ability to buy adequate sports equipment. Therefore, creative and innovative solutions are needed to utilize easily available and inexpensive materials, such as used rubber bands. Used rubber bands are one of the materials that are often considered waste and unused, even though they have the potential to be reused. Utilizing used rubber bands as a jump rope sports tool is one way to reduce waste and create sports equipment that is cheap and easily accessible to the public (Dudagoitia Barrio et al., 2023).

Rubber compositions are made from natural rubber or synthetic materials such as latex, available in a variety of strengths and strengths to meet a variety of needs. Their uses range from household to industrial applications, including but not limited to paper binding, securing box closures, hair design and packaging. Despite their benefits, synthetic rubber can have an impact on the environment. Synthetic rubber does not biodegrade as quickly as materials

such as paper and can pose a risk to wildlife if not disposed of properly. While some synthetic rubbers are biodegradable, they take much longer to biodegrade.

This introduction aims to describe the importance of sports, especially rope jumping, and to present the potential of utilizing used rubber bands as an alternative to environmentally friendly and economical sports equipment. This research is expected to provide a positive contribution in reducing plastic waste and increasing community participation in sports at an affordable cost.

2. Literature Review

2.1. History of rope skipping

The history of rope jumping, or jump rope, is a rich tapestry that dates back to the 1600s, with its origins traced to China, where it was a popular activity during the Chinese New Year's Festivals. As practice spread, it crossed the Atlantic with Dutch settlers, who introduced it to America. Children in the New World began to engage in jump rope games, often accompanied by songs, leading to the creation of the term "Double Dutch," a name derived from the confusion English and French settlers felt towards the Dutch children's playful antics. Throughout the centuries, jump rope remained a staple of childhood play, especially among girls, who would use various materials to craft their ropes (Woodard, 2020).

However, by the 1950s, the rise of television and other forms of entertainment began to diminish the popularity of jump rope as children spent more time indoors. The sport saw a revival in the 1960s, largely due to the efforts of individuals like Richard Cendali, who introduced competitive elements and organized teams, such as the Skip Its. This resurgence led to the establishment of formal organizations, including the International Rope Skipping Organization (IRSO), which aimed to unify the sport and promote its competitive aspects. Despite its historical significance, the sport of jump rope has faced challenges in gaining mainstream recognition, and ongoing efforts are needed to increase public awareness and participation in this dynamic activity (Woodard, 2020).

2.2. Innovation in Waste Utilization in Sports Equipment

The intersection of sports and sustainability has sparked a growing interest in transforming waste into functional and high-performance sports equipment. By repurposing materials that would otherwise end up in landfills, innovators are not only addressing environmental concerns but also creating unique and often cost-effective products. For example, recycled plastic has been successfully incorporated into the manufacturing of sports apparel and footwear, reducing the demand for virgin materials (Kajon et al., 2023). Additionally, the use of discarded fishing nets in the creation of sportswear has gained traction, demonstrating the potential of upcycling in the sports industry. While challenges such as material consistency and performance standards need to be overcome, the development of innovative recycling technologies and the increasing consumer demand for sustainable products are driving progress in this field (Lusiana & Prasmala, 2022).

3. Methodology

3.1. Making tools from used rubber bands

Used rubber bands are collected from the surrounding environment, both from households, schools, and workplaces. It is hoped that the community can actively participate in collecting unused rubber bands. After being collected, these used rubber bands are sorted based on their size and elasticity. Rubber bands that are still elastic and undamaged are selected for use (Agustini and Dewi, 2017). Used rubber bands are cleaned using water and soap to remove dirt, dust, and other residues that stick to them. After being cleaned, the rubber bands are dried in a shady place so that they are not exposed to direct sunlight which can damage their elasticity.



Figure 1. Material after cleaning

The cleaned rubber bands are tested for flexibility by stretching them several times. Rubber bands that are still strong and elastic will be used to make a jump rope, while those that break easily or are less elastic will be discarded. The selected rubber bands are measured for length and adjusted to the needs of making a jump rope. Ideally, the rubber bands used have enough length to provide flexibility and strength when used as a jump rope.

Rubber bands that are too long or too short are cut and connected to other rubber bands to achieve the desired length. The rubber bands are connected to each other by tying the ends to form a long rope. This connection must be strong and not easily loose so that the jump rope can be used safely. The connecting technique used must ensure that the rope will not break or come loose when used for jumping. The jump rope that has been formed from used rubber bands is tested for strength by stretching it to the maximum and using it to jump several times. Ropes that are proven to be strong and durable will be used for fitness testing, while those that break easily will be repaired or replaced.



Figure 2. The process of connecting or making high jump equipment traditionally

3.2. Fitness Measurement Tools

In this study, various fitness measurement tools were used to ensure accurate and comprehensive data on the physical condition of participants before and after using the rope skipping tool made from used rubber bands. The first tool is a stopwatch, which is used to measure the duration of rope skipping activities each day. The stopwatch helps in calculating the time spent by participants doing rope skipping activities and calculating the duration until participants reach fatigue during the fitness test.

Furthermore, a pedometer is used to count the number of jumps made by participants during each training session. This tool is attached to the participant's waist or ankle and automatically counts the number of jumps each time the participant jumps. The pedometer provides quantitative data on the participant's physical activity, making it easier to analyze the increase in the number of jumps over time.

A heart rate monitor is also used to measure the participant's heart rate during and after rope skipping activities. This monitor is attached to the participant's wrist or chest, depending on the type. The heart rate monitor monitors the participant's cardiovascular condition and records changes in heart rate before, during, and after the activity, thus providing a clear picture of the body's response to the exercise.

In addition, a fitness measurement scale is used to assess changes in the participant's physical fitness before and after the training period. This scale includes a series of fitness tests that measure aspects such as muscle strength, endurance, flexibility, and cardiovascular health. Before the exercise, participants underwent an initial fitness test to obtain baseline data. After the exercise period was completed, the fitness tests were repeated to assess any changes that had occurred.

4. Results and Discussion

4.1. Results

The following are the results of the physical fitness measurements of participants before and after using the jump rope tool made from used rubber bands during the 2-week training period:

Table 1. Fitness measurement data of participants before and after jumping rope exercise from used rubber bands

Participant	Resting Heart Rate (bpm)	Maximum Number of Jumps in 1 Minute	Duration to Reach Exhaustion (minutes)
	Before	After	Before
A	72	68	85
B	75	70	90
C	70	66	80
D	74	69	87
E	71	67	82

Resting heart rate measurements showed an average decrease from 72 bpm to 68 bpm after the training period. These changes indicate an increase in cardiovascular efficiency. In participant A, resting heart rate decreased from 72 bpm to 68 bpm, while participant B experienced a decrease from 75 bpm to 70 bpm. Participant C showed a decrease from 70 bpm to 66 bpm, participant D from 74 bpm to 69 bpm, and participant E from 71 bpm to 67 bpm. The decrease in resting heart rate in all participants indicates that rope training contributes to improved heart health and overall cardiovascular efficiency.

The maximum number of jumps per minute showed a significant increase from before to after training. Before training, participant A could do 85 jumps, while after training, this number increased. Participant B initially did 90 jumps, which increased after training. Participant C, who could do 80 jumps before training, showed an increase after the training period. Participants D and E, who started with 87 and 82 jumps respectively, also showed an increase. The increase in the average maximum number of jumps indicates that the training had improved the participants' stamina, leg muscle strength, and coordination, allowing them to perform more jumps in the same amount of time.

The duration to exhaustion also increased, indicating an increase in the participants' endurance. Before the training, Participant A reached exhaustion after 5 minutes, while after the training, this duration increased. Participants B, C, D, and E also experienced an increase in the duration to exhaustion after the training period. This increase in duration reflects the body's adaptation to the training, where participants were able to exercise longer before feeling exhausted. This suggests that the jump rope not only increased muscle stamina but also improved the participants' aerobic endurance.

4.2. Discussion

The following is a discussion of the measurement results summarized in the table:

Table 2. Average changes in fitness parameters before and after exercise

Aspect	Before Practice	After Practice	Average Change
Resting Heart Rate	72.4 bpm	68 bpm	-4.4 bpm
Maximum Number of Jumps	84.8 Jump	110 Jump	+25.2 Jump
Fatigue Duration	5.2 Minute	7.2 Minute	+2 Minute

4.2.1. Data Analysis

The results showed that the participants' average resting heart rate decreased from 72.4 bpm to 68 bpm after the training period. This decrease indicates an increase in the participants' cardiovascular efficiency, indicating that the participants' hearts were becoming more efficient at pumping blood. This efficiency is an important indicator of improved cardiovascular health and overall physical fitness. A decrease in resting heart rate is generally due to an increase in the volume of blood pumped per heartbeat, meaning the heart does not have to work as hard to meet the body's oxygen needs.

The average maximum number of jumps per minute increased significantly from 84.8 jumps to 110 jumps after the training period. This increase indicates a significant increase in the participants' stamina and leg muscle strength, as well as improved coordination and rhythm during rope jumping. The ability to perform more jumps per minute also indicates an increase in speed and anaerobic endurance, which are important elements in a variety of physical activities and sports.

The average time to exhaustion increased from 5.2 minutes to 7.2 minutes after the exercise period. This increase in duration indicates an increase in participants' endurance, allowing them to exercise longer before feeling fatigued. This increase in endurance is a positive indicator of participants' increased aerobic capacity, meaning their bodies are becoming more efficient at using oxygen during prolonged physical activity. It also indicates a positive adaptation of the respiratory and muscular systems to the exercise.

A jump rope tool made from used rubber bands has several advantages. First, it is cheap and the raw materials are easy to obtain. Second, this tool is environmentally friendly because it utilizes plastic waste, thus contributing to waste reduction efforts. Third, this tool is easy to make and use by anyone, making it very practical and accessible to a wide range of people.

However, this tool also has several disadvantages. The elasticity of the rubber band can decrease over time, especially with frequent use, so it needs to be replaced periodically. In addition, the knots that hold the rubber bands need to be checked periodically to ensure they do not come loose during use. These checks and maintenance are important to maintain the safety and effectiveness of the jump rope tool.

4.2.2. Implications and Benefits

a). Environment

Utilizing used rubber bands as jump ropes can help reduce plastic waste and promote recycling of used materials. This initiative supports environmental conservation efforts by reducing the amount of plastic waste that ends up in landfills.

b). Social

Using jump ropes from used rubber bands can raise public awareness of the importance of exercise and fitness at an affordable cost. This tool provides a cheap and easily accessible alternative for people to exercise, thereby increasing participation in physical activity and supporting overall public health.

c). Economic

By providing an alternative to cheap and easily accessible sports equipment for various groups of people, this initiative can provide economic benefits. People who may not be able to afford expensive sports equipment can still maintain their fitness using equipment made from used materials. In addition, the production of this equipment can be a business opportunity for individuals or groups interested in producing and selling it.

5. Conclusion

This study shows that the use of used rubber bands as a skipping rope sports equipment has significant potential in improving physical fitness and providing an environmentally friendly solution for sports equipment. Some of the main conclusions of this study are:

- a). The skipping rope equipment made from used rubber bands was proven to be effective in improving the physical fitness of participants. This was demonstrated by a significant increase in the number of maximum jumps per minute and duration before exhaustion, as well as a decrease in resting heart rate.
- b). A two-week training program using this equipment showed improvements in cardiovascular efficiency, stamina, and endurance of participants.
- c). The use of used rubber bands as raw materials for sports equipment makes a positive contribution to efforts to reduce plastic waste and encourage recycling practices.
- d). The skipping rope equipment made from used rubber bands offers an affordable and accessible alternative to sports equipment, enabling wider participation in physical activity.

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