

## Title of Project

'Soggy Socks'

## Investigation Question

Which type of sock dries the quickest and what effect does material have on the speed at which socks dry?

## Student Names

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(Stage 3 – Year 5)

# Abstract

## What did I do?

We measured the rate of evaporation of four different types of socks made from different materials (wool, cotton, nylon and polyester).

**Why did I do this?** We wanted to do this because, when camping in a damp, wet area socks can get wet. Sometimes socks don't exactly dry fast enough. That is where our experiment comes in. We used four different types of socks and compared which one dries the quickest. We wanted to know which sock dries fastest as this will be the socks to pack when going on camp.

## How did I do this?

We did this by conducting three trial tests and measuring how much each sock weighs when we added water and then again after several periods of time. The one that had the most amount of evaporation had, (in grams) dried the quickest. That is the way we did our experiment.

## What did I find out?

We discovered that cotton is the quickest at drying, ahead of Nylon, Polyester and then Wool which is the slowest at drying. We also found out that the internet could be wrong when coming to an experiment, because in our end results we found out cotton dried quickest but not many websites said cotton was quick at drying.

## Conclusion:

Overall the material cotton dried the fastest out of the four different fabrics and if we were embarking on a school camping trip and it was wet or damp it would be best to pack cotton socks and clothing so that you can enjoy your trip and not get 'Soggy Socks'.

# Introduction

## Background Information / Research Findings - Why it is of interest, what is already known and what have others done?

This topic is of interest because it is helpful to know which types of fabric dry the quickest as this could influence one's choice of clothing. We found some information on websites which said:

Polyester is a strong, durable and resistant over wrinkles and is a fabric that dries very quickly. Polyester doesn't absorb the moisture that could come in. On this same website there was also another material that we were using in our experiment that was also good at drying quickly, that was nylon. Nylon dries quickly and dirt doesn't like to cling to it making it very easy to wash and dry.

On the second website it said again:

Nylon is exceptionally strong and low in moisture absorbency which makes it dry quickly. It also said that polyester was abrasion resistant as well as it was good at drying. We also found that: Cotton is the worst wet- weather as it absorbs water like it is crazy and takes the ages of time to dry. This is not a good material to bring to those wet camps.

The material wool insulates the body but cotton does not insulate the person when wet. Wool is supposed to stay warmer when damp than cotton does. One website suggested that polyester and nylon are the best sock materials and cotton and wool are the worst. Another one said that wool can absorb a significant amount of water, when wet it can feel very soggy. However it was suggested that cotton is a soft, natural fiber that absorbs moisture. Cotton can provide softness, moisture absorption and temperature control.

## Background information gathered from outside experts

Doctor Tracey Palmer's knowledge: My hypothesis is the polyester sock. It is synthetic and it will dry the quickest. Wool is my second hypothesis because sheep stand out in the fields and it has lanolin to coat it but the lanolin might not be in the socks, it might have been taken out in the factories.

## Aim / Purpose

The aim or purpose of our experiment was to investigate and determine whether some types of material dry more quickly than other types of material. Our school goes on an OEG camp every year and very often it is rainy and wet. The students walk in the rain and their clothing and socks get soaking wet. On arrival back at the cabins, we try to hang our clothing up to dry so that we can use our clothing the next day. We wanted to find out which type of material dries the quickest so that we can use this information on camp and only take clothing made from materials which dry very quickly, since we don't have tumble driers at the cabins.

## Hypothesis / Prediction

If I change the type of material of the clothing (*Independent Variable*) by selecting different kinds of socks made from different materials, for example wool, nylon, cotton and polyester then we **predict** that the Nylon sock will dry the fastest because some of the information and research that we gathered off the internet suggested that the fabric Nylon is thinner than wool, cotton and polyester so it should dry the fastest. So the (*Dependent Variable*) will be the water because we measured the evaporation of the four socks in their plastic tubs with the water in them. (Mass of socks and water in grams) We started off with 106 grams in each tub and then it gradually decreased in weight so that cotton finished drying the fastest.

# Variables

## Independent Variable

The Independent Variable which is what we **changed** in in this experiment would be the material of socks (nylon, polyester, wool, cotton). We changed this to see which sock can dry the quickest and to do that we have to change the material to compare. This is very important for our experiment as it is a part of our aim and purpose.

## Dependent Variable

The dependent variable which was what we **measured** in this experiment was the mass of the four types of socks, as we needed to measure them every assigned period of time, in the three trial tests we performed. We measured the socks before and after some of the water had evaporated. This helped in us succeeding in our experiment.

## Controlled Variables

The controlled variables were all factors that we kept the **same**. These include: weight of each sock to start, amount of water, types/size/weight of plastic tub, type of electronic scale, time of measurement. We kept them the same to make this a fair experiment. The weight of the sock needs to be fair because if it wasn't then our experiment would come out the wrong way as the socks would have had different weights in the beginning. This is same for the amount of water. We made sure the tubs were all the same type (plastic), same size and weight (15g).

## Materials & Methods / Procedure

Before doing the experiment we needed to be organised and get the materials we were going to need to make our aim and purpose come true. Our materials included: scales to use for our dependent variable, socks of these four materials: cotton, wool, nylon, polyester, four plastic tubs for four different socks (material), water to pour onto the socks, a glass beaker to pour the water and a cylinder to measure the water carefully. We used a stopwatch to time our experiment, also we needed to use a pencil and paper to record our data and a clock to check the time.

Firstly we discussed and assigned who would be a speaker, director or manager. Then we recorded and discussed our Aim/Purpose of our experiment and why it could be helpful. Then we discussed the potential risks and dangers of doing our experiment. We then made our COWS MOO SOFTLY chart which is, COWS-what will we change, MOO-what will we measure, SOFTLY- what will we keep the same and listed these in our table. When we got the chance, we asked our parents and friends what they knew about materials drying and what their hypothesis was before recording our hypothesis. Then we gathered our materials that are listed above and made sure that the four socks were equal in mass by cutting them before putting them in their own four plastic tubs. Then we measured the amount of water that needed to be poured on to each sock. We added the water (65millilitres) and recorded the mass in grams of the socks and water to see if they were all equal at 106g. After that every hour we measured the evaporation that was happening and then the next day we measured the mass every 10 minutes and recorded it in our science books. After that we completed two more trial tests and recorded the data. Afterwards, when we had finished our three trial tests we discussed our results and made our table of results and then our graph. We copied them into our logbook and then typed out everything we did with the dates and images. We also completed our risk assessment and looked at some background research on materials and socks. To finish we worked on and completed our Investigation 'Soggy Socks' report (this document) and showed it to the teacher so that she could check and edit it after we had self checked it.

# Risk Assessment

We discussed as a group and a class about the risks and dangers of conducting this experiment. We thought about all the materials and how they could affect or harm us in any possible way. Then we made suggestions and recorded the worthwhile ones.

**Dropping a Glass Beaker:** If you drop a glass beaker it could be potentially dangerous because you could slip on the broken glass or cut yourself with it.

**Dropping the Electronic Scale:** If you drop it then it would be unable to work and not be useable thereafter.

**Paper Cut:** We could get a paper cut from using paper to record our data getting a paper cut could lead to loss of blood.

**Cutting Yourself:** You could cut yourself if you crack/break the plastic tubs and it could hurt. You could also cut yourself with scissors and need to take care when cutting things up.

**Sock Water:** If you accidentally drink the sock water it could be dangerous because the dyes could have leaked into the water and it could make you ill.

**Spilt Water:** If you spill water and slip you could get hurt.



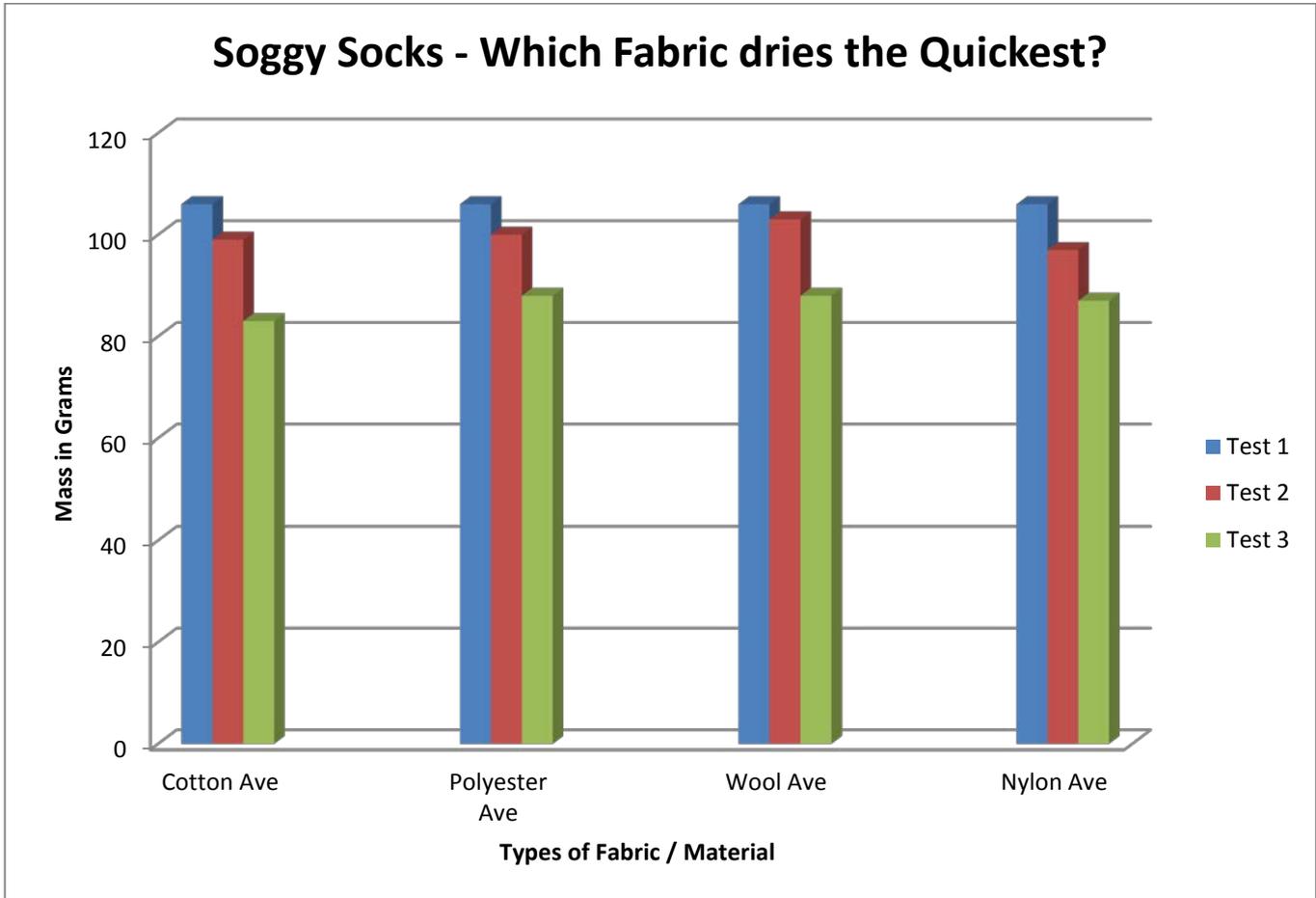
## Table of Results

Tests	Measure 1	Measure 2	Measure 3	Average
Cotton <u>1</u>	106g	104g	102g	96g
Cotton <u>2</u>	106g	89g	66g	
Cotton <u>3</u>	106g	94g	80g	
Cotton Average	106g	99g	83g	
Polyester <u>1</u>	106g	93g	71g	98g
Polyester <u>2</u>	106g	104g	101g	
Polyester <u>3</u>	106g	103g	91g	
Polyester Average	106g	100g	88g	
Wool <u>1</u>	106g	104g	71g	99g
Wool <u>2</u>	106g	102g	101g	
Wool <u>3</u>	106g	104g	91g	
Wool Average	106g	103g	88g	
Nylon <u>1</u>	106g	85g	68g	97g
Nylon <u>2</u>	106g	103g	102g	
Nylon <u>3</u>	106g	104g	91g	
Nylon Average	106g	97g	87g	

## Explanation of Results

The table of results shows us that when we measured the mass of the four socks first they were all equal in weight and then on the second measurement the sock that dropped in weight the most was nylon and the wool sock evaporated the least. Then in the final measurement when we worked out our averages, the cotton concluded with evaporating the most and the woollen sock held the water in and didn't evaporate a lot. The nylon sock had the second most effective evaporation or loss of water.

# Column Graph Results



## Explanation of Graph

This graph shows that in trial test 1 all the socks were the same at 106g and then in trial test 2 the sock that decreased the least in mass was the woollen sock and the sock that showed the highest evaporation was the nylon sock. Then in trial test 3 the sock that had the least evaporation was the sock made from woollen material and the material that decreased (in grams) the most was the cotton sock.

# Discussion

- Describe any trends / patterns
- In cotton test 1, the mass went down in 2g
- In Polyester test 2 the mass was going down in consecutive numbers when subtracting
- If you rearrange the averages of the weights in the table of results and column graph it is consecutive
  
- Can you explain the trends?
- In cotton test 1 the number decreased like this: 106g, 104g, 102g
- In Polyester test 2 when subtracting the numbers I found the difference going down in consecutive number for example: the difference between  $106-104=2$ , then  $104-101=3$ , as you can see it is subtracting like 2, 3, 4, etc
- When rearranging the averages we got numbers that were in a consecutive pattern, it looked like this 96g, 98g, 99g and 97g rearranged it looks like this: 96g, 97g, 98g and 99
- Were there any anomalies? (things that stand out as unusual or unexpected)
- There was one anomaly in trial test 2. The cotton decreased in mass much faster than in trial test 1 and 3.
- We were surprised by cotton being the quickest at drying because in our hypothesis we suggested that cotton would dry the slowest and the research also suggests this.
- How could you improve the study?
- Next time we should get some socks that are all the same colour e.g. white.
- We could add less water so that the evaporation happens faster and we could do more trial tests in a smaller amount of time.
- We could hang the socks up as if on a washing line instead of placing them in a plastic tub.

# Discussion continued...

## Fairness, bias, accuracy, replication

To make our experiment a fair test we had to measure the same amount of liquid and pour it at the same time. There are however, a few factors which could have contributed towards the fairness of our experiment. Firstly, the water was poured out of the glass beaker at different times. Perhaps another factor that could have affected the fairness in our tests was the colour of the socks and the dye could have leaked into the water and made the mass larger. We think that we could have had some bias when looking at the colours of the socks and past experiences with wet/damp socks and that may have been why our hypothesis was inaccurate and cotton was our choice of the slowest evaporating material. In our first trial test we didn't add enough water so we replicated it so it would be fairer.

## Any ideas for future work.

We had many ideas on different experiments we could do in the future like:

- Seeing how long it will take for a glass of water to evaporate
- Which material can soak the most water compared to others
- Which is the best angle (north, south, east, west) to dry clothes the fastest
- Which is the best laundry liquid or powder cleans socks the best
- Which brand of water has the most acidic pH
- Which brand of sock has the best features
- Is the most expensive socks really what they say they are or is it just all fake.
- Could the same amount of evaporation happen to juice like it does to water.
- What would happen if we poured another liquid other than water on the socks?  
Would the same outcome appear?
- Which brand/type of sock doesn't make you perspire as much as other socks
- Will the brand of water effect the evaporation of the water.

## Conclusion

### *Do your results support or disprove your hypothesis?*

Our results **disprove** my hypothesis as we predicted that Nylon would dry the fastest and evaporate the most over a period of time because they are thinner than wool, polyester and cotton because in the end results cotton evaporated the most and is the fastest drying out of the four materials/fabrics that we used. However many websites suggested that cotton was the slowest at drying. Overall if we were embarking on a school camping trip and it was wet or damp it would be best to pack cotton socks and clothing so that you can enjoy your trip and not get 'Soggy Socks'.

## Useful Applications

### *How is the information & data gathered useful to us and society?*

When going to choose a some socks/clothes/materials at a store to use and you live in a wet/damp climate or you are thinking about going on a camping trip it will be very useful to know that the Cotton material dries the fastest in front of Nylon, Polyester and then Woollen. Also if someone was on a camping trip and they fell into a lake or dam and they were very cold then they could wrap themselves in a cotton towel or blanket and it would dry quickly. On a plane they serve food and water to you and it would be good if the seat fabric was cotton or mostly cotton so that if a child or adult spilt something it would dry quickly and you would have a mostly comfortable trip. If you were walking and you had a cotton hat on and there was a chance that it could rain, the cotton hat that you were wearing would dry quickly and your walk would be very enjoyable.

# References

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<http://travelfashiongirl.com/how-to-choose-the-best-fabrics-for-travel/>

<http://www.fibersource.com/f-tutor/q-guide.htm>

[http://www.adventuregearpost.com/know-how/clothing\\_fabrics.asp](http://www.adventuregearpost.com/know-how/clothing_fabrics.asp)

<http://www.drymaxsocks.com.au/faqs.php>

<http://snarkynomad.com/why-merino-wool-socks-make-the-best-travel-socks/>

# Acknowledgements

- 1) **Teacher** – We would like to thank Mrs Venish for providing us with the opportunity to conduct our group investigations. She assisted us by providing us with our materials, helping us with our tables and graphs, checking our work and giving us time during class to complete our work. She also gave up her spare lunchtimes to assist us in completing our work.
- 2) **Parents** - We would like to thank our parents for assisting us on their knowledge of materials and their opinions and hypothesis about our experiment.
- 3) **Other students** - We would like to thank our class for assisting us in their background knowledge. With a special thankyou to Phoebe Wedderburn for telling us her hypothesis and opinion in where to buy the socks.
- 4) **Outside experts** - We would like to thank Dr Tracey Palmer for assisting us with her background knowledge and her hypothesis of the polyester sock resulting in evaporating the fastest.

# Scientific Journal / Log

**Date:** 28/ 4 / 2015

**Journal:** We began our investigation by thinking about real world problems that needed to be solved which could be used in our science investigation. As a class, we brainstormed a variety of ideas for problems to investigate. Some of us decided that we wanted to find out if some socks dry more quickly than others. We go on OEG (Outdoor Education Group Camps) every year and often in very rainy weather. Our socks get very soggy and we wanted to find out if there was a type of sock with specific material that would dry more quickly.

**Problem:** On rainy days when you are wearing socks, your socks will get wet and it would be very handy to know which sock material stays wet the longest so you could avoid that sock.

**We posed investigation questions and our question was:** Which sock fabric dries the quickest out of Cotton, Nylon, Polyester and Wool.

With **Group planning** we discussed our roles and decided that Ankitha and Sienna would be Managers who have the important job of collecting and putting away all of the materials that we used. Hamilton was the Speaker, he had the job of asking for help from the teacher if we got confused or something went wrong. Zoe was the Director which explains what to do and ensures that everyone stays on the right track and does not get mixed up!

**Date:** 04/5/2015

Our teacher told us about what goes into our report and we read a sheet of paper and talked about how we have to create a great log book, discuss ideas between our group peers and buy the products. We also talked about how we had to think up hypotheses and fair tests had to be performed when we were experimenting with the 'Soggy Socks'.

**Date:** 05/5/2015

**Purpose/Aim:** Which fabric (socks) dries the quickest once wet or damp, so that your feet don't get cold or get fungal infections from being wet or damp.



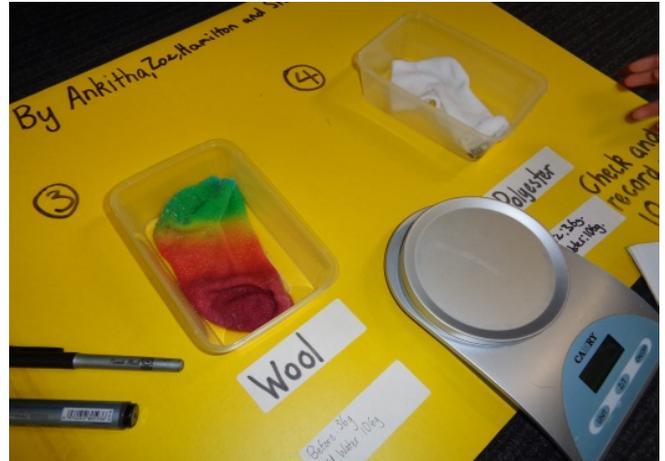
## Soggy Socks Experiment – Zoe and Ankitha

**Introduction:** If you were going camping with your friends/family or someone you know and you were going to have a fun time, then it rained and your socks got wet/damp you would like to know that if you dried over a period of time (overnight) that they would be dry when you put them on again. Our investigation results tell you which sock dries the quickest and is best to take on camping trips so you can have a great time with comfortable socks (that are not wet)!

18/5/2015

**Background Research:**

On the first website it said that it was good to wear wool, it was great for damp areas and camping. Mrs. Venish agreed and thought wool (in her prediction) would dry quickest. On the second website when cotton gets wet it is supposed to take a long period to dry. Some websites disagree with other websites for example we also found another website where it said cotton was both comfortable and the quickest to dry!



**Variables- Cows-Moo-Softly scaffold:**

COWS-what will we <b>change</b> ?	MOO-what will we <b>measure</b> ?	SOFTLY-what will we keep the <b>same</b> ?
<ul style="list-style-type: none"> <li>We are changing the sock fabric to compare which is better(Wool, Nylon, Polyester, Cotton)</li> </ul>	<ul style="list-style-type: none"> <li>The weight before and after the water added and when it evaporates.</li> <li>We measure it using an electronic scale</li> </ul>	<ul style="list-style-type: none"> <li>The 4 types of socks</li> <li>Amount of water</li> <li>Same sock size</li> <li>Types/size/weight of plastic tub</li> <li>Type of electronic scale</li> <li>Time of measurement</li> </ul>

**Roles:** Managers are the people who collect and returns materials and organize things like the time and tables/graphs. The Speaker asks the teacher or other students for help if the group or individual does not understand the tasks. The Director makes sure that the team understands the investigation process and completes it step by step to make sure they are heading in the right direction.

<b>Managers</b>	<b>Speakers</b>	<b>Directors</b>
Ankitha Avvari Sienna Fuller	Hamilton Taylor	Zoe Moutsopoulos

**Materials:**

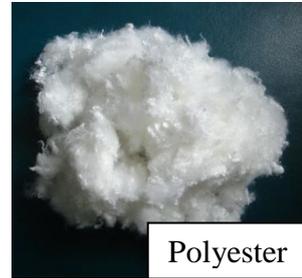
- Electronic scales



## Soggy Socks Experiment – Zoe and Ankitha

- Pair of each sock (cotton, wool, nylon, polyester)
- Water
- 4x plastic tubs
- 4x glass beakers
- Stopwatch
- Clock

19/5/2015



### Potential risk analysis:

Before doing our first trial test we thought about the risks or dangers that may appear when using the equipment or. We also found ways to prevent the risks and make it easier to do the experiment. These risks might not sound important, but it still is a risk that could happen to harm us.

- Dropping glass beaker on any part of the body
- Dropping the electronic scale in water and getting electrocuted
- Getting paper cuts from science books
- Cutting yourself on the plastic tubs if they crack
- Choking from putting water in your mouth
- Water the sock is in might be dangerous because of the toxin in the dyes could leak into the water
- Spilling the water and slipping



19/5/2015

**Methods:** Firstly we discussed and decided about the roles of the Directors, Speakers and Managers, then we thought about and discussed the risks of handling the equipment and other possible dangers. We gathered all the equipment we needed and put the 4 socks one at a time and the 4 plastic tubs on the electronic scales and

## Soggy Socks Experiment – Zoe and Ankitha

weighed them to make sure they were the same size. After that we placed the socks on a poster and weighed them every hour and then the next morning. We did this three times and recorded the results in our science books. After that we made a table of results and averaged the three other tables.

13/7/15-16/7/15-22/7/15-24/7/15-30/7/15-31/7/15

Mrs. Venish lets us work in the ICT room to finish our Logs for the school Science Fair and the Young Scientists Awards.

**01/8/15**

**Research:** On one of the websites we found it said:

Polyester is a strong, durable and resistant over wrinkles is a fabric that dries very quickly. Polyester doesn't absorb the moisture that could come in. On this same website there was also another material that we were using in our experiment that was also good at drying quickly, that was nylon. Nylon dries quickly and dirt doesn't like to cling to it making it very easy to wash and dry.

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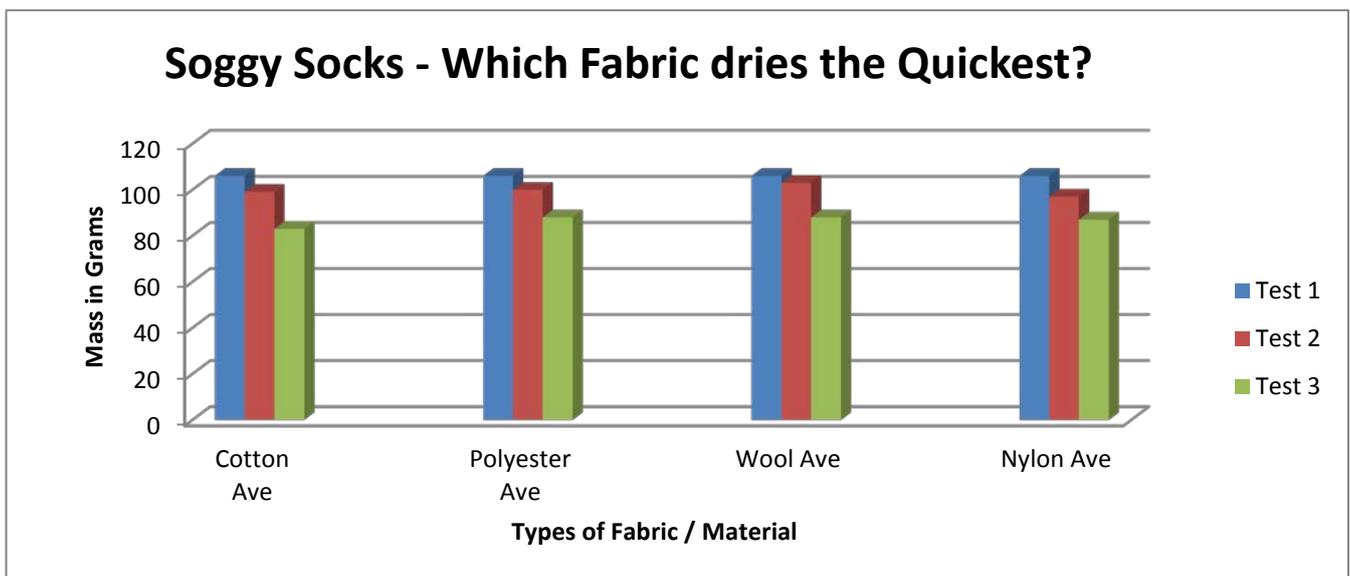
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The material wool insulates the body but cotton does not insulate the person when wet. Wool is supposed to stay warmer when damp than cotton does. One website suggested that polyester and nylon are the best sock materials and cotton and wool are the worst. Another on said that wool can absorb a significant amount of water, when wet it can feel like a plastic garbage bag. However it was suggested that cotton is a soft, natural fiber that absorbs moisture. Cotton can provide softness, moisture absorption and temperature control.

### Soggy Socks-Column graph or Results

**Table of results**



## Soggy Socks Experiment – Zoe and Ankitha

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**Conclusion:** Our results **disprove** our hypothesis as it was that Nylon would dry the fastest and evaporate the most over a period of time because they are thinner than wool, polyester and cotton because in the end results cotton evaporated the most and is the fastest drying out of the four materials/fabrics that we used. However many websites suggested that cotton was the slowest at drying. Overall if we were embarking on a school camping trip and it was wet or damp it would be best to pack cotton socks and clothing so that you can enjoy your trip and not get 'Soggy Socks'.

**FUN FACT**  
 The first real socks were invented in the year 1589.  
 The first animal skin sock was made in ancient Greece.

