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A Review on cold protective cloth by using fabric materials on various ambient temperature

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ABSTRACT: Having to do one's duties or work under cold conditions is a worldwide issue. The design of cold-season protective gear is a complex process that must take into account the influence of many aspects, both external and internal, including weather conditions and the wearer's own physical, physicochemical, and mental characteristics. The purpose of this study is to offer a literature assessment on efforts to enhance cold-protecting cloth via the use of various textiles. Denser fabric is used for cold protection since it is more challenging to control ventilation and temperature in such a fabric. This study explores the various insulating materials now on the market and the fundamental aspects that go into the design of cold protective apparel.
Keyword; Cold Protective Cloth, Fabric, Textiles, Hypothermia, Basal Metabolic Rate (BMR).

1. INTRODUCTION

The yearly mortality rate has decreased in recent years, although it remains high overall. As the severe winter that hit most of Europe shown, the weather may take a sudden and unwelcome turn for the worse. It's possible that people aren't well prepared for extreme weather. Those in less developed regions who cannot afford effective protection against wintertime temperatures have less hope while wealthier nations continue to deal with the problem of cold weather-related mortality, with casualties being even greater. People who aren't prepared for the cold are more likely to become sick or die. It's possible that no one ever found out what killed them. No other species on Earth can compare to the potential impact of a single human life. In light of this, every individual's life is irreplaceable for the value they provide to the world, no matter how little their impact may seem. We can only progress as a species and solve the obstacles we face as individuals and as a whole because of the complex social network in which we are all interconnected. Hence, fighting against fatalities caused by cold weather is a moral imperative since it's everyone's right.

A. Cold weather effect on human body

The optimal interior temperature for a person is 37 degrees Celsius, give or take 0.5 degrees. This is shown in the illustration by the dark orange color, which represents an inactive person. This person prefers a skin temperature of 33–44.5 degrees Celsius. Temperatures may vary locally, but should stay within the normal range of 32 to 35.5 degrees Celsius. The circulation of blood throughout the body of a person will be at its best under such circumstances. When exposed to cold, the body stops sending blood to the extremities. The figure's orange coloration in the middle conveys this idea. The life-sustaining organs are shielded by a surge of concentrated blood. The risk of hypothermia in cold environments necessitates taking measures to prevent heat loss. As a result, the body expends a great deal of energy shivering, a process in which the skin contracts and the muscles contract and expand fast to raise the body temperature and so protect the interior organs. When the body's other heat production mechanisms have failed, this is what it does. The stress level will rise as a result of other environmental conditions, such as snow, ice, and darkness. When a person's core temperature drops below 35 degrees Celsius, the last stage of hypothermia has arrived. The effects may vary from one individual to the next because of differences in BMR. How many calories you would burn if you remained in bed all day is known as your basal metabolic rate (BMR).

2. Literature review

(Hegde, 2022) The research on design and development cold winter jacket has been carried out by using three layered fabrics. Madder root natural dyed cotton fabric as inner layer, silk as middle layer and polyester as top most layer. People frequently wear winter jackets when going outside to protect themselves from the Cold climate. The research is mainly focused on peoples in Jammu and Kashmir. Winter jackets keep us warm due to the material they are made of. The three-layered winter jacket keeps our body to generate heat, which the material helps to trap and prevent from escaping into the air. Winter clothing is clothing that is worn to keep warm during the colder months of the year. They frequently have strong water resistance and are made up of numerous layers to protect and insulate against cold weather. Cotton fabric had good absorption and has good deodorizing properties, so dyeing with Madder root improves its properties drastically. The uniqueness of this research is to bring three layered winter jacket were the third layer is naturally treated with madder root dye. The layering of the jacket will bring warmth and comfortableness to peoples. The winter jacket was constructed by using foam material and suitable accessories.

(Halász et al., 2022) The purpose of this research was to determine whether wearing highly compressed, form-fitting athletic clothing had any effect on the physiology of the athlete. Four subjects ran progressively faster on a treadmill while wearing one of three distinct types of compression clothing. Test subjects' core temperatures, skin surface temperatures, and sweat rates were all measured to ascertain the compressive impact of the sportswear on the test subjects' bodies and the efficiency with which it wicks away heat as they ran. According to the findings, an athlete's clothing physiology is greatly affected by the compression effect produced by the clothes; a larger compression load results in more intense perspiration and a higher skin temperature.

(Abou Elmaaty et al., 2022) Consumers nowadays are enlightened enough to realise that modernising their classic garb might enhance their quality of life. Those who wear clothes care most about how soft and practical the fabric is. To better serve consumers, several textile technologies are in development. Nanotechnology has rapidly risen in importance in recent years. The textile sector has seen a meteoric rise in the use of nanotechnology because of its distinctive and practical properties. Fibers or fabrics with nano sized (109) particles are created by different finishing, coating, and manufacturing procedures utilised in the creation of high-performance textiles. Cotton has been a staple in human diets for thousands of years, and now it makes up around 34% of the world's total fibre output. It is widely used in the textile, apparel, and medical fields. Properties such as antibacterial properties, self-cleaning, UV protection, and more may be boosted in cotton textiles by using nanotechnology. Here, we provide findings from studies examining the feasibility of incorporating nanotechnology-enhanced functionalities into cotton textiles.

(Laza et al., 2022) This study is a first step in developing thermosensitive and water resistant polyurethane fibres for use in the textile sector. In order to achieve this goal, two polyurethane formulations with glass transition temperatures (Tg) close to body temperature have been synthesised and characterised using various methods like Ther- Mo gravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC), Dynamic-Mechanical Analysis (DMA), and Thermo-mechanical Analysis (TMA) (TMA). This allowed us to analyse their shape- and temperature-memory properties. The polyurethane films' permeability to water vapour was also assessed. Later, to create thermo-regulating materials, extrusion was used to integrate 2 kinds of microencapsulated phase change materials (PCMs), one consisting of an organic shell and the other with an inorganic shell. Both unmodified polyurethane fibres and fibres that had been filled with microencapsulated PCMs were evaluated once again to ensure that their thermal and shape memory characteristics had not changed and to investigate their energy storage and release potential. These encouraging findings open the door to a new class of thermo-regulating materials with wide-ranging potential uses, including the textile industry..

3. Conclusion

In this investigation, we created an experimental cloth material for thermal insulation. Under very cold environments while replicating real-life use. Their resistance to the cold was tested in a range of conditions, including variations in temperature, humidity, and wind speed. This research explores a number of options for improving the warmth and cosiness of cold-weather protective clothing, such as switching to a new fabric with superior insulating qualities. According to a cursory literature assessment, adding more layers of cold protection material will only lead to an increase in temperature beneath cold protective fabric.

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