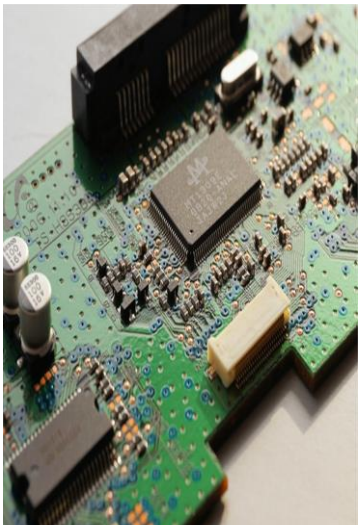
ISBN: 9798425593016

INTERNATIONAL JOURNAL of ENGINEERING AND APPLIED COMPUTER SCIENCE

EMPIRICAL RESEARCH PRESS

Volume: 04 | Issue: 01 | February | 2022






EMPIRICAL RESEARCH PRESS LTD.
United Kingdom

IJEACS

International Journal of

Engineering and Applied Computer Science

Empirical Research Press Ltd.

London, United Kingdom

Volume: 04, Issue: 01

ISBN: 9798425593016

www.ijeacs.com

Indexing, Hosting and Advertising

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Content

International Journal of Engineering and Applied Computer Science
Volume: 04, Issue: 01, February 2022

Studying Effects of Fabric Thickness, Loop Shape Factor, Fabric Tightness Factor and Aerial Weight on Thermal Conductivity of Plain Single Jersey Cotton Knitted Fabric using Box Behnken Design

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***Abstract*— The paper aims at studying the effects of fabric aerial weight, thickness, tightness factor, and loop shape factor on thermal conductivity behavior of plain single jersey knitted fabrics made with cotton yarn. 25 samples have been collected from the market. The samples are collected on the basis of their variation in the stated factors. Accordingly, statistical analysis is computed by using Design expert software version 11. For analysis Box, Behnken design (BBD) method is followed and made 30 runs of experimentation. A confidence level of 0.95 is used for prediction. The correlation coefficient between the predicted and the actual values are calculated to be 93.76%. The analysis shows fabric tightness factor and loop shape factor significantly affects the thermal conductivity of plain single jersey knitted fabrics. In addition, the interaction of fabric aerial weight & tightness factor, the interaction of fabric aerial weight & loop shape factor, and interaction of thickness & tightness factor also significantly affects the thermal conductivity behavior of the knitted fabric.**

Keywords-aerial weight, thickness, tightness factor, loop shape factor, thermal conductivity

I. INTRODUCTION

Knitted fabrics are most commonly chosen as they make the wearer feel comfortable because they have a soft texture and are flexible also. As this is the case, to make even better the comfort properties of these garments' studies have been conducted on Physiological thermal comfort and sensations of the fabrics. [1-4]

Clothing comfort is categorized into four classifications as: psychological, thermo-physiological, and tactile and garment fit comfort. Psychological comfort relates with fashion trends, the thermo-physiological comfort is concerned with air, moisture and heat movements through the fabric. Sensorial comfort is dependent on the fabric surface and that of garment fit comfort is relying on fitness of the garment material on the body. Amongst these, the thermal comfort property is dependent on fibre, yarn & fabric properties, finishing treatments, etc. For assessment measurements have to be made with thermal conductivity, thermal resistance, air permeability and water vapor permeability. [5]

Thermal conductivity of a knitted fabric is determined by the heat transfer process through the fabrics. The heat exchange process in the fabric is influenced by the fabric structure and the materials used to construct the fabric.

The thermal conductivity of natural fibres is higher as compared with protein fibres. The heat conductivity of a fabric decreases when the fabric increases in its thickness and surface mass. Specific area also affects it. Fabric texture has also a considerable influence on thermal resistance of a fabric.

A tighter/denser fabric does exhibit a decreased heat loss since the air circulation through the fabric decreases.

Özçelik et al reported on their studies that knitted fabrics made with texturized PES filaments exhibit a lower thermal conductivity property than a knitted fabric made with non-texturized PES filament yarn. [6]

The other influencing factor for heat interchange process is the fabric structure. Plain knitted fabric structures exhibit a faster and higher heat transfer than other designs produced in flat double bed knitting machines.

Cubric et al studied the factors affecting the heat conductivity properties on a single jersey knitted fabrics and reported a strong relation between fabric thickness, aerial weight and tightness factor on heat resistance of their sample fabrics. [7]

Demiryürek and Uysaltürk on the other hand compared the thermal conductivity of 1x1 rib fabric with a single jersey. They take samples made with cotton blend and polyester blended one. They have found that the rib fabric tends to have a higher thermal conductivity than the single jersey one as the rib fabric is having a higher fabric thickness, minimum air gap and a higher aerial weight. [8]

EsraTaştanÖzkan et al investigated the thermal comfort properties of polyester knitted fabrics. They found that, fabric having a higher thickness value with lower number of filaments shows the lowest thermal conductivity. [9]

It has been studied that variation in input yarn tension while making the single jersey fabric significantly affects fabric aerial weight (GSM). [10]

One way ANOVA statistical analysis technique/method has been used for showing the correlation between mechanical yarn stretch % in sizing with warp yarn breakage in looms & the same method has been followed for analyzing the relation between input yarn tension with fabric aerial weight. [11]

On the other hand using Box Behnken design, effects of fabric thickness, loop shape factor, aerial weight & tightness factor on water vapor permeability of single jersey knitted fabrics have been studied in detail. [12]

In this research, it is planned to see the effects of fabric thickness, loop shape factor, fabric tightness factor, and aerial weight on thermal conductivity of plain single jersey knitted fabrics made with 100% cotton. Design expert software is used for analyzing the significance of the factors on the thermal conductivity. For analysis Box Behnken design is used.

II. MATERIALS & METHODS

Plain knitted single jersey fabric made with 100% cotton yarn is used for experimentation. All the samples are purchased from market.

Table 1 Description of the samples

SCP describes sample made with cotton and having plain design

The characterized parameters are tested following standard testing procedures.

S. no	Experimental code	Fabric composition	Count (Ne)	Sample fabric structure	Wales/inch	Course/inch	Fabric aerial weight (GSM)	Thickness (mm)	Loop length (mm)	Fabric tightness factor ($tex^{1/2}$/loop length in mm)	Loop shape factor (CPI/WPI)
1	S_1CP	100% cotton	60	Plain single jersey	48	66	142.1	5.4	2.6	1.2	1.36
2	S_2CP	100% cotton	40	Plain single jersey	48	66	169.7	5.1	2.5	1.54	1.36
3	S_3CP	100% cotton	40	Plain single jersey	52	60	169.7	5.4	2.5	1.54	1.15
4	S_4CP	100% cotton	40	Plain single jersey	48	66	142.1	5.4	2.5	1.54	1.36
5	S_5CP	100% cotton	55	Plain single jersey	48	66	169.7	5.4	2.4	1.37	1.36
6	S_6CP	100% cotton	55	Plain single jersey	48	66	197.3	5.1	2.4	1.37	1.36
7	S_7CP	100% cotton	55	Plain single jersey	52	60	169.7	5.7	2.4	1.37	1.15
8	S_8CP	100% cotton	55	Plain single jersey	48	66	197.3	5.7	2.4	1.37	1.36
9	S_9CP	100% cotton	60	Plain single jersey	48	66	169.7	5.7	2.6	1.2	1.36
10	S_{10}CP	100% cotton	55	Plain single jersey	52	60	197.3	5.4	2.4	1.37	1.15
11	S_{11}CP	100% cotton	55	Plain single jersey	48	66	142.1	5.1	2.4	1.37	1.36
12	S_{12}CP	100% cotton	60	Plain single jersey	52	60	169.7	5.4	2.6	1.2	1.15
13	S_{13}CP	100% cotton	55	Plain single jersey	56	88	142.1	5.4	2.4	1.37	1.57

S. no	Experimental code	Fabric composition	Count (Ne)	Sample fabric structure	Wales/inch	Course/inch	Fabric aerial weight (GSM)	Thickness (mm)	Loop length (mm)	Fabric tightness factor ($tex^{1/2}$/loop length in mm)	Loop shape factor (CPI/WPI)
14	$S_{14}CP$	100% cotton	55	Plain single jersey	52	60	169.7	5.1	2.4	1.37	1.15
15	$S_{15}CP$	100% cotton	60	Plain single jersey	56	88	169.7	5.4	2.6	1.2	1.57
16	$S_{16}CP$	100% cotton	55	Plain single jersey	56	88	197.3	5.4	2.4	1.37	1.57
17	$S_{17}CP$	100% cotton	40	Plain single jersey	48	66	197.3	5.4	2.5	1.54	1.36
18	$S_{18}CP$	100% cotton	55	Plain single jersey	56	88	169.7	5.7	2.4	1.37	1.57
19	$S_{19}CP$	100% cotton	60	Plain single jersey	48	66	197.3	5.4	2.6	1.2	1.36
20	$S_{20}CP$	100% cotton	55	Plain single jersey	56	88	169.7	5.1	2.4	1.37	1.57
21	$S_{21}CP$	100% cotton	55	Plain single jersey	52	60	142.1	5.4	2.4	1.37	1.15
22	$S_{22}CP$	100% cotton	55	Plain single jersey	48	66	142.1	5.7	2.4	1.37	1.36
23	$S_{23}CP$	100% cotton	40	Plain single jersey	48	66	169.7	5.7	2.5	1.54	1.36
24	$S_{24}CP$	100% cotton	60	Plain single jersey	48	66	169.7	5.1	2.6	1.2	1.36
25	$S_{25}CP$	100% cotton	40	Plain single jersey	56	88	169.7	5.4	2.5	1.54	1.57

A. *Experimentation*

Before testing is made, all the samples are conditioned with a room temperature of 220c & a relative humidity of 63%. The conditioning is made for 24 hrs.

Fabric thickness test: The test is conducted following ASTM D 1777.

Fabric GSM: using GSM cutter and electronic balance following ASTM D 3776 with a specimen size of 100cm^2.

Loop length: of a knitted fabric is calculated by using the formula:

Loop length=course length/No. of loops

Tightness factor: is calculated with the formula:

Fabric tightness factor=tex$^{1/2}$/loop length

Loop shape factor: is calculated with the formula:

Loop shape factor=CPI/WPI

Fabric composition: test is made with ISO 1833:2012 test method with MLR ratio of 1g of fabric: 200 ml of (75% conc. H2SO4)

Thread density (Wales/inch & course/inch): is counted using picks glass.

III. RESULTS & DISCUSSION

Accordingly, considering the above-stated internal properties of the sample fabrics test for thermal conductivity has been carried out.

Thermal conductivity test: the test is made using ALAMBETA instrument following ISO 31092. For all the specimens, the measuring head temperature was kept 300c and the contact pressure 180Pa.

A. *Statistical analysis of factors on thermal conductivity behavior of the samples*

The statistical analysis is made using design expert software following Box Behnken design.

File Version	**11.0.3.0**		
Study Type	Response Surface	**Subtype**	Randomized
Design Type	Box-Behnken	**Runs**	30
Design Model	Quadratic	**Blocks**	No Blocks

Build Time (ms)	142.00

Table 2 Experimental results for thermal conductivity

		Factor 1	**Factor 2**	**Factor 3**	**Factor 4**	**Response 1**
Std	Run	A:Fabric aerial weight GSM	B:Thickness mm	C:Fabric tightness factor	D:Loop shape factor	Thermal conductivity W/mk
17	1	142.1	5.4	1.2	1.36	0.026
15	2	169.7	5.1	1.54	1.36	0.038
6	3	169.7	5.4	1.54	1.15	0.042
19	4	142.1	5.4	1.54	1.36	0.046
27	5	169.7	5.4	1.37	1.36	0.039
26	6	169.7	5.4	1.37	1.36	0.041
2	7	197.3	5.1	1.37	1.36	0.04
22	8	169.7	5.7	1.37	1.15	0.04
4	9	197.3	5.7	1.37	1.36	0.042
14	10	169.7	5.7	1.2	1.36	0.024
10	11	197.3	5.4	1.37	1.15	0.043
1	12	142.1	5.1	1.37	1.36	0.044
5	13	169.7	5.4	1.2	1.15	0.032
28	14	169.7	5.4	1.37	1.36	0.042
11	15	142.1	5.4	1.37	1.57	0.039
29	16	169.7	5.4	1.37	1.36	0.041
21	17	169.7	5.1	1.37	1.15	0.041
7	18	169.7	5.4	1.2	1.57	0.026
25	19	169.7	5.4	1.37	1.36	0.043
12	20	197.3	5.4	1.37	1.57	0.034
20	21	197.3	5.4	1.54	1.36	0.036
24	22	169.7	5.7	1.37	1.57	0.041
18	23	197.3	5.4	1.2	1.36	0.029
23	24	169.7	5.1	1.37	1.57	0.041
9	25	142.1	5.4	1.37	1.15	0.039
30	26	169.7	5.4	1.37	1.36	0.037
3	27	142.1	5.7	1.37	1.36	0.041
16	28	169.7	5.7	1.54	1.36	0.044
13	29	169.7	5.1	1.2	1.36	0.03
8	30	169.7	5.4	1.54	1.57	0.04

Table 3 ANOVA for thermal conductivity

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	0.0009	14	0.0001	16.09	< 0.0001	significant
A-Fabric aerial weight	0.0000	1	0.0000	2.45	0.1384	
B-Thickness	3.333E-07	1	3.333E-07	0.0810	0.7799	
C-Fabric tightness factor	0.0005	1	0.0005	126.34	< 0.0001	
D-Loop shape factor	0.0000	1	0.0000	5.18	0.0379	
AB	6.250E-06	1	6.250E-06	1.52	0.2369	
AC	0.0000	1	0.0000	10.26	0.0059	
AD	0.0000	1	0.0000	4.92	0.0424	
BC	0.0000	1	0.0000	8.74	0.0098	
BD	2.500E-07	1	2.500E-07	0.0607	0.8087	
CD	4.000E-06	1	4.000E-06	0.9717	0.3399	

A^2	5.833E-07	1	5.833E-07	0.1417	0.7119	
B^2	2.333E-06	1	2.333E-06	0.5668	0.4632	
C^2	0.0003	1	0.0003	60.80	< 0.0001	
D^2	1.190E-06	1	1.190E-06	0.2892	0.5986	
Residual	0.0001	15	4.117E-06			
Lack of Fit	0.0000	10	3.825E-06	0.8138	0.6357	not significant
Pure Error	0.0000	5	4.700E-06			
Cor Total	0.0010	29				

The Model F-value of 16.09 implies the model is significant. There is only a 0.01% chance that an F-value this large could occur due to noise.

P-values less than 0.0500 indicate model terms are significant. In this case C, D, AC, AD, BC, C^2 are significant model terms.

The Lack of Fit F-value of 0.81 implies the Lack of Fit is not significant relative to the pure error. There is a 63.57% chance that a "Lack of Fit F-value" this large could occur due to noise.

The ANOVA analysis for the experimentation shows that the model is adequate and fitting. As the P-values indicate fabric tightness factor and loop shape factor significantly affects the thermal conductivity of plain single jersey knitted fabrics. Additionally, the interaction of fabric aerial weight & tightness factor, the interaction of fabric aerial weight & loop shape factor and interaction of thickness & tightness factor also significantly affects the thermal conductivity behavior of the knitted fabric.

The experimentation indicates fabrics with higher tightness factor exhibits higher thermal conductivity values. Tighter fabrics do have more number of yarns and thus a higher fibrous assembly will be there. So, the assembled fibrous materials will act as a conductive media and let the heat to pass through them. But the samples with lesser tightness factor are loose and more porous with higher air gap in the structure. As air is not a good conductive media of heat their thermal conductivity values is lower. Thus, the experiment shows fabric tightness factor directly and significantly affects fabric thermal conductivity.

The same is true for loop shape factor. As the factor increases the fabric will get denser and it will be dimensionally stable as the number of course yarns increase. The higher the yarn constituting in the fabric, the denser the fabric will be and because of the less porosity of the structure the thermal conductivity of the fabric will get higher. So, the analysis indicates loop shape factor has a direct correlation with the thermal conductivity behavior of a knitted fabric.

The interactions also show the same relation. As the fabrics' GSM and tightness factor increases, the thermal conductivity will also increase. When the fabric has a higher aerial weight and loop shape factor it will be denser and bulkier leading to higher thermal conductivity of a fabric.

For point prediction confidence level of 95% is used. The plot for predicted vs. actual values of the thermal conductivity in fig. 1 below shows that results are distributed around the regression line. This indicates that the model is unbiased and hence it is adequate & fitting. The calculated correlation coefficient between them is 93.76%.

In fig. 2 also a 3D surface graph showing the effects of fabric thickness & aerial weight on the thermal conductivity behavior is there. The other 2 factors have been kept constant with values of 1.37 & 1.36 for fabric tightness factor & loop shape factor respectively. As different mesh colors are shown in the surface graph, blue is for the lowest thermal conductivity value & red is for the highest one. Since, fabric aerial weight & thickness are not significantly affecting thermal conductivity behavior of plain single jersey knitted fabrics used in this experimentation, much color change is not observed in the surface graph.

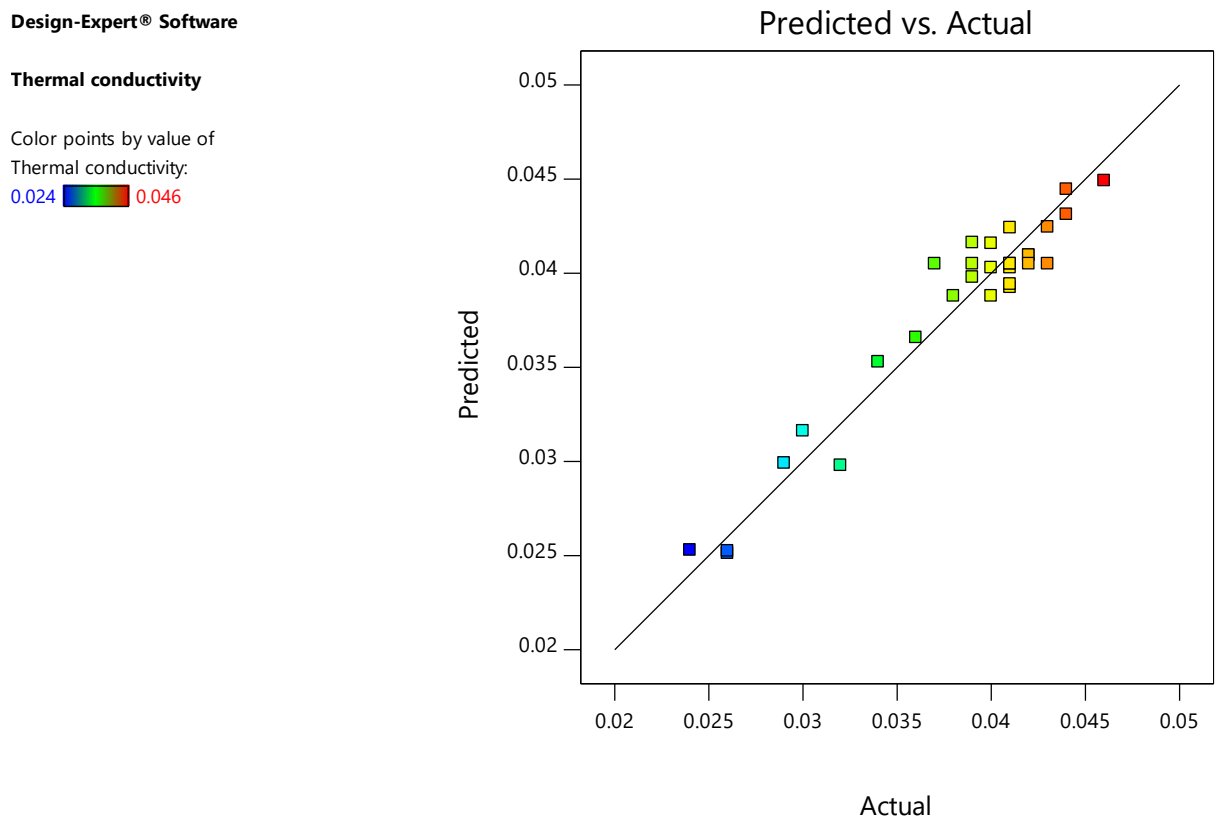

Fig. 1 Plot for predicted vs. actual values of thermal conductivity

Table 4 Calculated R^2

Std. Dev.	**0.0020**	R^2	**0.9376**
Mean	0.0380	**Adjusted R^2**	0.8793
C.V. %	5.33	**Predicted R^2**	0.7430
		Adeq Precision	13.7951

Adjusted R^2 of 0.8793; i.e. the difference is less than 0.2.

Adeq Precision measures the signal to noise ratio. A ratio greater than 4 is desirable. 13.795 indicate an adequate signal.

The Predicted R^2 of 0.7430 is in reasonable agreement with the

Regression Equation in Terms of Actual Factors

Thermal conductivity	=
+0.177063	
+0.000758	*Fabric aerial weight
-0.182160	*Thickness
+0.373338	*Fabric tightness factor
+0.025423	*Loop shape factor
+0.000151	*Fabric aerial weight * Thickness
-0.000693	*Fabric aerial weight * Fabric tightness factor
-0.000388	*Fabric aerial weight * Loop shape factor
+0.058824	*Thickness * Fabric tightness factor
+0.003968	*Thickness * Loop shape factor
+0.028011	*Fabric tightness factor * Loop shape factor
-3.82885E-07	*Fabric aerial weight^2
+0.006481	*Thickness^2
-0.209054	*Fabric tightness factor^2
-0.009448	*Loop shape factor^2

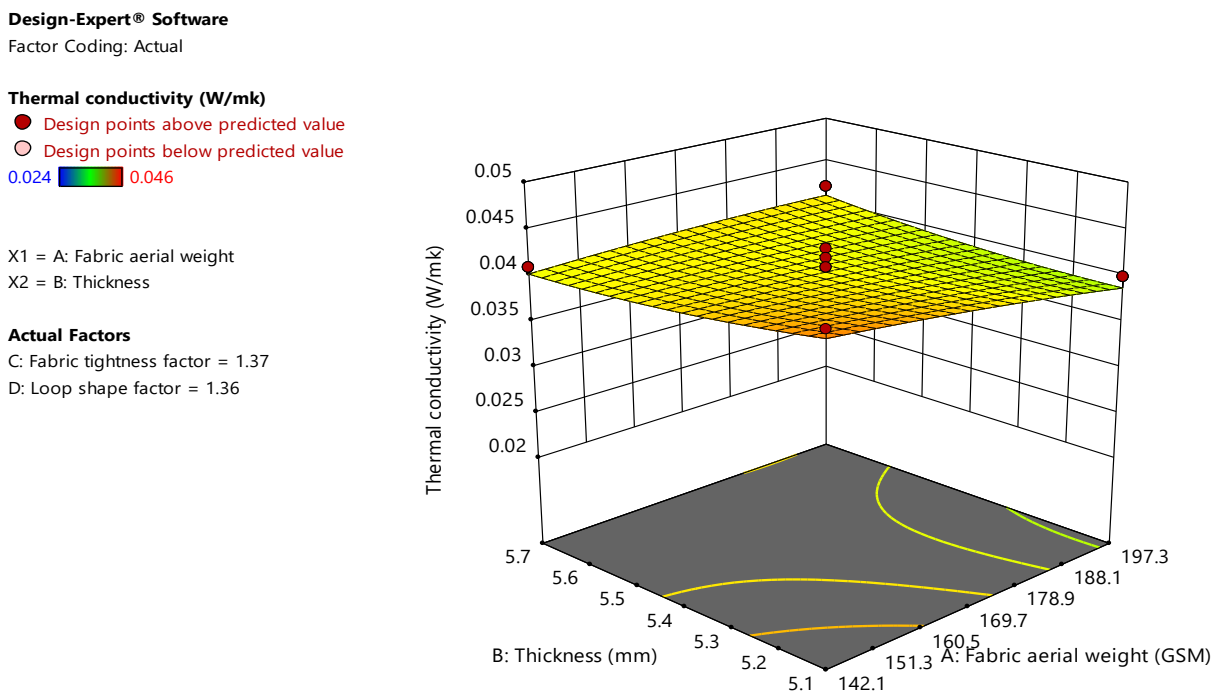

Fig. 2 3D surface for showing factor effects on thermal conductivity behavior

IV. CONCLUSION

In general, the experimentation indicates that fabric tightness factor and loop shape factor significantly affect the thermal conductivity of plain single jersey knitted fabrics. Additionally, the interaction of fabric aerial weight & tightness factor, interaction of fabric aerial weight & loop shape factor and interaction of thickness & tightness factor also significantly affects the thermal conductivity behavior of the knitted fabric. Thus, the experiment shows fabric tightness factor directly and significantly affects fabric thermal conductivity. The analysis also indicates loop shape factor has a direct correlation with the thermal conductivity behavior of a knitted fabric. By using a confidence level of 95% point prediction is made and the calculated correlation coefficient is 93.76%.

ACKNOWLEDGMENT

For conducting this experimentation, mostly I have used lab. Facilities in Ethiopian textile industry development institute. I thank the lab. Technicians & management staffs for helping me conduct the research work.

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Mr. Neway Seboka has got his BSc degree from Bahir Dar University, polytechnic campus, Ethiopia in 2012. He also received his M.Tech degree from the Indian Institute of Technology, Delhi, India in 2017. Currently, he is working as a researcher in the Ethiopian Textile Industry Development Institute. He has published more than 8 articles in peer-reviewed and reputed national and international journals.

International Journal of Engineering and Applied Computer Science
Volume: 04, Issue: 01, February 2022

Education and the Use of Artificial Intelligence

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***Abstract*—This paper explains how Artificial Intelligence (AI) can and is being applied in the educational sector. Artificial Intelligence in the educational sector is one of the currently expanding disciplines in educational technology, according to the 21st International Conference on Artificial Intelligence in Education, held in 2020. Educators are still unsure how to apply AI for pedagogical purposes on a larger scale, or how AI will affect teaching and learning in higher education. The impact of AI in education, as well as its benefits and drawbacks, are discussed. It also explains how to construct an AI-enabled platform for education, as well as the consequences of AI in education.**

Keywords-Artificial Intelligence; Education; emerging; teacher-education.

I. INTRODUCTION

Experts predict that the usage of AI in education will expand by 43 percent between 2018 and 2022, according to the 2018 Horizon report. The use of artificial intelligence in education has been a research topic for the past 30 years. According to a report published by Research and Markets, the global AI Education market was worth $1.1billion in 2019 and is expected to reach $25.7 billion by 2030. The psychologists B. F. Skinner, widely known as the father of behaviorism, who was a professor at Harvard University from 1948 until his retirement in 1974, and Sidney Pressey, who was a professor at Ohio State University in the 1920's, are the forerunners on the application of AI in education.

II. ARTIFICIAL INTELLIGENCE IN EDUCATION

The International Artificial Intelligence in Education Society (AIED) is a multidisciplinary organization that works at the intersection of computer science, education, and psychology. On January 1, 1997, the International AIED Society was established. The International Journal of AI in Education (IJAIED) and the AIED conference series bring together researchers. Profiling and Prediction, Assessment and Evaluation, Adaptive systems, Personalization, and intelligent tutoring systems are four areas of AIED in academic support services and institutional and administrative services. Artificial intelligence is both inventive and derivative. Artificial Intelligence (AI) is a new technology that has begun to alter educational tools and organizations. Education is a field in which teachers must be present, as this is the finest educational practice. Artificial Intelligence has altered the role of teachers, who are vital in the educational system. For monitoring the speed of a certain individual among others, AI mostly employs advanced analytics, deep learning, and machine learning. As AI solutions advance, they aid in the identification of gaps in teaching and learning, as well as increasing educational proficiency. AI can improve efficiency, personalization, and administrative responsibilities, giving teachers more time and freedom to focus on understanding and adaptability, which are distinctively human qualities. It is feasible to get the best outcomes from pupils with a combination of machines and professors.

III. THE IMPACT OF ARTIFICIAL INTELLIGENCE IN EDUCATION

Almost every aspect of our lives will be touched by AI in the future, and the education sector will be the most impacted of all, because teaching and learning is such an important part of life, and the existing educational system leaves a lot to be desired. Schooling in the past was not as adaptable as it will be in the future with AI in education. Teachers, who are the most significant part of the educational system, are not scalable and are also significant. Teachers in certain nations are burdened with a pile of paperwork and are undervalued. Individuals can benefit from AI by receiving an individualized curriculum based on their interests and skill assessments.

IV. BENEFITS OF ARTIFICIAL INTELLIGENCE IN EDUCATION

Young people nowadays spend a lot of time on their cellphones or tablets. This allows individuals to use AI applications to study for 10 to fifteen minutes during their free time. Using Gesture Recognition Technology, AI helps us identify the mood or ease of the students during lectures. As AI becomes more sophisticated, the computer reads the student's facial expressions or movements and uses them to determine whether the student is struggling to understand the lecture and adjusts the course accordingly so that the student can easily follow along. Academic curriculum customization can be done

by AI-powered computers. AI techniques can help create global classrooms that include people from all around the world visually or audibly challenged. This may also be beneficial to students who are unable to attend class due to illness. In a traditional school system, students are graded on their assignments and tests, which takes up a lot of time. When AI is introduced, these duties will be completed quickly. It also aids in the suggestion of methods for bridging learning gaps. It also aids in the suggestion of methods for bridging learning gaps. People who speak multiple languages or have hearing or visual impairments can benefit from AI's resources. Presentation Translator is an AI-based system application that delivers real-time subtitles. Students, for example, can read and hear in their native language using Google Translate. Modern technology like as virtual reality and gamification can assist create more participatory sessions. There have already been several settings where multiple-choice examinations have been scored by machines, and now progress is being made in the direction of grading written type answers such as paragraphs and assertions by computers. This makes a teacher's job easier because no time is lost, and the time saved may be used to focus more on individual student evaluation and improvement. AI can be used to automate admissions and enrollment processes in the future, but its full potential has yet to be realized. Students can use AI to assist them with their schoolwork or test preparations at home. AI will be able to respond to a variety of learning styles in the near future. Tutoring and studying programmes are now possible thanks to Artificial Intelligence. AI will be able to respond to a variety of learning styles in the near future. Tutoring and learning programmes are becoming more advanced thanks to Artificial Intelligence. In the field of education, applications such as AI mentors for students are being created. AI can classify students into groups that are best suited for specific tasks. Adaptive Group Formation is the term for this. Software that uses artificial intelligence to grade student essays in real-time. These writings are entered into a central database, and future articles can be compared to the database's prior entries. In education, artificial intelligence is a computer-based system that provides personalized, adaptable, and insightful instruction. Domain Knowledge Model is one of the most important components of the AIED system since it gives the system the ability to accomplish tasks and allows students to assess whether or not they should contribute to the solution. The Student Model is a representation of a learner's evolving knowledge and skills. The Model of Pedagogy component depicts the system's teaching capability, while the Interface component offers the communication channel between the learner and the system. The Voice Assistant is another AI component that is extremely effective in education. It's a game-changing AI application. This includes Google Assistant, Microsoft's Cortland, Apple's Siri, and Amazon's Alexa. These voice assistants allow students to communicate directly with instructional materials on the internet and on installed devices without the need for their teacher's involvement. Traditional learning methods are becoming obsolete, and numerous educational institutions and colleges are gradually abandoning them. They have already begun to provide students with voice assistance rather than printed study materials or websites with complex information for their campus-related information. For example, Arizona State University is providing Amazon's Alexa to incoming students to provide them with more regular, clear, and precise institutional information on their campus needs. Voice Assistants can be used to access any learning aid at home or in other noneducational settings. The main goal of the Voice Assistants is to provide answers to common questions about campus needs or for a specific schedule and courses of each student, which helps the institution save money on printing handbooks that are only used temporarily during the initial period of their enrollment and reduces the need for internal support. In the following years, the use of this technology is projected to increase. Artificial intelligence is becoming an increasingly important part of our daily lives, so it's no surprise that educational systems are racing to keep up with the demand for new talent to keep the AI growth engine running. However, education is progressing in other areas as well, such as Science, Technology, Engineering, and mathematics (STEM). However, the AI curriculum is transforming the education business. Smart systems are rapidly revolutionizing educational institutions, from basic to higher education, as well as adult and advanced learning, in order to assist people to learn more effectively and achieve their learning objectives. To encourage one-on-one personal tutoring, the Intelligent Tutoring System is deployed. They can make a verdict against an individual student based on neural networks and algorithms. With the help of AI, students are already being introduced to a wide range of higher education options. AI has the potential to transform the sector of education completely. Robots can improve grammatical accuracy and produce digital material. Digitalized instruction has already begun in the classrooms.

Universities will be impacted in the future by a cascade of investments and greater interest in artificial intelligence. The rise of the worldwide student market, the democratization of higher education, and the rise in financial strain due to the rise in the number of students interested in pursuing higher education will all be fundamental reasons for higher education to seek out AI.

V. EDUCATIONAL AI SOLUTION

In the education market, there are several tech-driven solutions such as Dream Box, Khan Academy, Achieve3000, and others.

There are many AI-based educational platforms available:

- Third Space Learning
- Little Dragon
- CTI
- Brainy
- Thinker Math
- Carnegie learning

The Third Space Learning system was developed with the assistance of London University College scholars. It aids in the recommendation of ways to improve teaching skills, such as issuing a warning when the teacher's explanation is either slow or excessively rapid. The Little Dragon develops intelligent software that analyses the user's facial expressions and

gestures. As a result, the user interface should be adjusted. Children's instructional games are also created by Little Dragon. Several firms, such as Carnegie Learning and Content Technology, have pioneered the use of artificial intelligence (AI) in educational systems from Pre-K to college level by building high-level instructional design and digital platforms. Cram101, an online tool from CTI, using artificial intelligence

To analyze textbooks and theoretical papers and pinpoint the material's highlights. As a student exercise, it also generates practice quizzes and flashcards. Net-ex Learning, another platform, is committed to the application of new technologies in the realm of learning and aims to deliver digital learning in educational institutions and businesses. It encourages tutors to promote digital curricula that incorporates audio, video, and voice assistants, among other things. Technologists believe that in the near future, robots will be able to replace teachers. In addition, augmented reality will be used in the classroom.

VI. Benefits of Artificial Intelligence in Education

To create an AI platform for education, there are six essential steps. Step 1: Problem definition i.e. Understanding the problem Step 2: Data gathering Step 3: Feature definition Step 4: AI model construction Step 5: Evaluation & refinements Step 6: Deployment To begin, we must carefully analyze existing solutions and add new features to them so that the user is drawn to your solution rather than the others. Examine the design concepts. Users always choose useful material, thus areas such as medicine, literature, math, and others are available. This important information can also be received from university or college tutors, as well as from other sources such as courses and training programmes. Before you start working on the project, you should figure out what your business goals are and what the project needs are. The development team should be made up of skilled software developers who have worked with Artificial Intelligence before. You can start with a simple version of your application or platform, and then update it on a regular basis, adding new content or features, after getting feedback from users and reviews. In order to attract more people, a great user experience should be offered. This can occur when there are no customer complaints, and for this to occur, we must first identify and address any flaws before launching the platform. Qualified Quality Assurance Engineers can perform this bug fix. Upgrades are made on a regular basis with the help of user's feedback.

VII. Drawbacks of AI in Education

Despite the vast prospects that AI provides, there may be certain risks associated with it. AI has the potential to be either the best or worst thing to happen to humans. While AI applications in higher education have the potential to improve teaching and learning, they also bring with them new ethical considerations and risks. Because of the ongoing coronavirus pandemic and budget cuts, administrators may consider substituting profitable automated AI solutions for instruction. If AI is used more in education, there is a risk that personal contacts will disappear and kids would become technology hooked, which can sometimes harm pupils rather than benefit them. Faculty, student counselors, teaching assistants, and administrative personnel may be concerned that the Intelligent Tutor System, which uses AI, may replace them. AI systems necessitate a large quantity of data, including personal student and staff information, which raises major privacy concerns. AI is extremely expensive when compared to the cost of installation, maintenance, and repair. Only the most well-funded educational institutions can afford to use such advanced technologies. When people rely on technology too much, it can lead to a loss of personal connections, which can be harmful to users. We can never know how much data is lost when natural disasters or accidents occur and an AI needs to be repaired.

VIII. Conclusion

The use of artificial intelligence in education is a game-changer. The next level uses of AI in education, according to research published by the Centre for Integrative Research in Computer and Learning Sciences, has yet to be invented. As a result, anyone working on AI applications should inform educators and education policymakers in great detail. Although there are various disadvantages to employing AI in the educational sector, our future is AI, thus educational institutions should begin exposing students to this type of technology, which has begun to incorporate AI. The impact of AI will be felt first at the lowest levels of schooling and will eventually rise to higher levels. The eventual impact of AI in education will be determined only by the passage of time. The basic goal of AI is to make a teacher's job simpler, not to replace them

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International Journal of Engineering and Applied Computer Science
Volume: 04, Issue: 01, February 2022

Mesenchymal Stem Cells and Their Use in Inflammatory Bowel Illness

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***Abstract*—New pharmacological, surgical, and endoscopic therapies have recently been developed to treat IBD. Among them, stem cell treatment is still in its early stages, despite the fact that multiple studies show that stem cell therapy's immunomodulatory function may decrease inflammation and tissue harm in IBD patients. Intralesional transplantation of autologous or allogeneic MSCs can be deemed a safe and successful therapeutic method for mending perianal fistulas in CD patients, according to this research, which analyses randomized clinical trials and their potential relevance. We did a thorough search of the literature to find research that looked into the function of stem cell treatment in IBD. Since multiple clinical trials have documented exacerbations of IBD following intravenous infusion of MSCs, this literature raises safety concerns about the systemic administration of MSCs.**

Keywords - Biology, Cells; Mesenchymal Stem; Bowel Illness.

I. INTRODUCTION

Inflammatory bowel disorders (IBDs), which include Crohn's disease (CD) and ulcerative colitis (UC), are chronic inflammatory illnesses of the gastrointestinal tract that have an exacerbation and remission phases. [1]. Although the actual cause of IBDs is unknown, various factors, including genetic, microbial, and environmental factors, as well as an abnormal immune response to the gut, have been implicated in the disease's development and progression. The family history of a person is a substantial and independent risk factor for getting IBD. [2]. IBD sufferers' families are unquestionably at a higher risk of developing the disease. For example, 13 percent of monozygotic twins have concordance with IBD, and the frequency of UC is many times greater among Ashkenazi Jews than in other ethnic groups, indicating that genetic background has a role in the development of IBD. In newly industrialized countries, there has been a sharp increase in IBD hospitalizations, suggesting that environmental variables are linked to the development and progression of IBD. Cigarette smoking has been shown in several epidemiological studies to increase the likelihood of acquiring CD while lowering the risk of hepatitis C infection [3-5]. Changes in the gut microbiota induced by repeated gastrointestinal infections have been linked to prolonged activation of the intestinal immune response, as well as a twofold risk of developing IBD in genetically vulnerable individuals.

When protected cells such as dendritic cells, macrophages, and T lymphocytes interact with bacterial lipoproteins and lipopolysaccharide, they can activate pro-inflammatory macrophages (M1) and DCs invading the gut, causing IBD (LPS). Actuated M1 macrophages subsequently make a slew of inciting cytokines, allowing a significant inflow of flowing leukocytes, neutrophils, and DC) into the afflicted gut, encouraging chronic enteritis [6].

Ingested bacterial antigens are converted to T cells by T cells, preparing them for a negative T-cell safe response. The gut release pro-inflammatory cytokines (IFN-, TNF-, and IL-17), which activate macrophages and neutrophils in an IFN-dependent and IL-17-dependent manner, resulting in a 'positive inflammatory loop.' Activated type (M2) macrophages, in contrast to inflammatory cells, operate as immune-regulatory cells in the gut, lowering detrimental immune responses and promoting gut remodeling and mucosal repair in an IL-10, TGF, and PGE2-dependent way. Provocative T cells, TGF DCs, and IL-10 are all suppressed by regulatory T lymphocytes (Tregs), which help to form the immunological gut environment. [7].

The colon is the focus of pathological alterations in UC patients, although CD be able to change the whole intestinal system. They can both cause stomach discomfort, fever, cramps, diarrhea, blood in the stool, exhaustion, and weight loss. These symptoms have a significant impact on a patient's capacity to live a normal life and can be deadly in some cases [8].

The 5-ASA drugs and antibiotics, together with immunomodulatory pharmaceuticals, are now considered standard treatment for IBD patients. However, because none of the currently known medications can completely erase inflammation in IBD patients' gastrointestinal tracts, this health therapy can just cause a medical reduction. As a result, novel treatment approaches for IBD are badly needed [9].

MSCs (Mesenchymal stem cells) are self-renewing cells that can suppress the immune system and differentiate into a

variety of cell types, including gastrointestinal epithelial cells. MSC-mediated intestinal inflammation reduction and MSC-dependent gut epithelial regeneration were revealed to be responsible for their therapeutic advantages in IBD patients. This chapter on the use of MSCs in the treatment of inflammatory bowel disease (IBD) focuses on present evidence and prospects [10].

II. Embedded mesenchymal stem cells in inflammatory bowel disease

During the stages of clinical testing of cancer stem cells for the treatment of disease, several problems arose that prompted researchers to develop sound strategies. The immune-mediated or anti-inflammatory properties of CSCs can produce quite opposite phenomena in inflamed environments. The major challenge in the treatment of IBD and clinical CAC has been the low efficacy of MSCs due to low survival and immunosuppressive capacity when translocated to the intestinal mucosa. Therefore, many technical departments have used MSCs to treat IBD and CAC to solve these difficulties. These treatments can be mainly divided into two types: those that enhance immunomodulatory function and those that improve survival in vitro and in vivo.

A. Improve cancer stem cells

To improve cancer stem cells' immune modifying activity in inflammatory bowel disease. Several methods will be used to improve the immune-modulating function of mesenchymal stem cells in IBD, including genetic modification of CSCs achieved through overexpression induced by plasmid and adenovirus transfection; it is also possible to use MSCs in combination with microRNA (modulators of cell function), a type of non-coding RNA, to provide relatively safe treatment. Increased CXCR4 expression is thought to hasten the diversion of BMMSCs to intestinal damage sites. While genetic editing has a number of benefits, it also has the potential to cause cancer. Immunosuppressive cytokines are secreted by MSCs pre-coupled with TLR3, which limit active T-cell proliferation, worsening the gut inflammatory process. Because the immature technology has kicked off a cascade of hazardous responses in practice, strategies to boost immune function in CSCs have not proven any benefit in preclinical studies for treating IBD [11].

B. CSCs associated

CSCs associated with inflammatory bowel illness should have better in vitro and intracellular survival. MSCs can be more easily preserved and transferred in a spherical shape to play a very effective role in the treatment of experimental enteritis in vivo by using melatonin for senescence and additional colony formation in vitro; MSCs can also be more easily preserved and transferred in a spherical shape to play a very effective role in the treatment of experimental enteritis in vivo by using melatonin for senescence and additional colon.

III. Preactivation of MSCs and preparation of MSC-conditioned medium

Blood was extracted from the carotid artery and collected in a clot-stimulating tube in a study on animals with colitis. The serum was separated from the blood by centrifuging it at 3000 rpm for 10 minutes, and the supernatant was filtered twice through 0.45 and 0.22 m membranes before being recovered from the colitis mice's serum.

The fat-containing MSCs were stained in full culture media at a concentration of 1 10 cells/mL in 75 cm 2 flasks and incubated at 37°C and 5% CO. The culture media and nonadherent cells were removed when the cells achieved 80% confluence. MSCs were treated with full medium with 10% rat colitis serum for 24 hours to create activated MSC-conditioned media. Colitis serum-treated (CM-AcMSC) or untreated (CMMSC) conditioned media were collected, centrifuged for 10 minutes at 2000 rpm to eliminate impurities, and filtered twice through 0.45 and 0.22 m membranes, respectively. The conditioned medium was then given to colitis mice by intravenous injection [12].

IV. MSC-Based Beneficial Effects in the Treatment of IBDs: Molecular Mechanisms

Expected in the direction of their immunoregulatory features, cancer stem cells are emerging as a viable cell treatment for IBD. All immune cells, including those implicated in the aggravation and remission of IBD, have been demonstrated to be influenced by cancer stem cells in terms of proliferation, activation, and effector function. The protected system is influenced by MSCs in a juxtacrine or paracrine manner. Because MSCs cannot produce cost molecules. The CSCs diminish the existence of effecter T cells in the swollen GI zone, decreasing inflammation caused by Th1 and Th17 [13, 14].

MSCs may reduce ongoing T cell-dependent inflammation by producing immunosuppressive chemicals, and nitric oxide (NO), as well as via paracrine and juxtacrine pathways. MSCs restrict the clonal proliferation of activated T cells in a PGE2-dependent way by downregulating IL-2 receptor expression. TGF- is also a powerful inhibitor of the IL-2 signaling pathway, and so contributes to activated T cell G1 cell cycle arrest produced by MSCs. MSC-derived NO and IDO, like NO and IDO, limits T cell growth by altering the cell cycle or metabolism.

Furthermore, MSCs regulate the antigen-presenting activity of DCs via PGE2, IL-10, and IL-6, preventing the development of Th1 and Th2. DCs stimulate M1 inflamed macrophages to polarise toward the M2 immunosuppressive phenotype, establishing a potential phenotype. CSCs reduce inflammatory cytokines (TNF-, IL-1, and IL-12) production while enhancing anti-inflammatory cytokines (IL-10 and TGF-), leading to better tissue repair and regeneration. [15]. M2 macrophages and tolerant DCs also increase the production of human immunosuppressive leukocyte antigen (HLA)-G5 in MSCs, which improves their ability to stimulate the generation and expansion of Tregs in an IL-10 and TGF-dependent manner,

contributing to the formation of an anti-inflammatory microenvironment in the intestine [16].

During the remission of IBD, epithelial cell interaction with invading immune cells in the gut is critical for mucosal repair of the injured gut mucosa. In the presence of keratinocyte growth factor (KGF), hepatocyte growth factor (HGF), epidermal growth factor (EGF), and insulin-like growth factor-II, CSCs can transform into intestinal epithelial cells in vitro, making it a viable factor. A source of intestinal epithelial renewal. However, because MSCs can acquire the phenotypic and functional properties of intestinal epithelial cells by fusion with resident intestinal epithelial cells, the exact process of MSC-dependent epithelium regeneration in vivo is uncertain [17].

V. M SCs as a Novel Therapeutic Approach for the Treatment of IBD Patients' Perianal Fistulas

According to epidemiological research. These fistulas are frequently treated in a progressive manner, with surgical therapy followed by the administration of immunomodulatory medications as well as biologics These therapeutic techniques did not lead to an increase in the amount of sinus finish in nearly partial of CD affected role, so many medical court-martials remained led toward examining the beneficial possible of intraoral stem cells in treating perianal sinuses for CD affected role. Local administration of cancer stem cells to treat CD fistula may, according to the data, be a unique and viable treatment technique in the near future so that it can be fully utilized for the patient. [18].

Because MSCs produced from IBD patients and healthy persons have similar morphological and functional properties were employed in the majority of clinical studies. Importantly, the source of transplanted MSCs and the treatment dose had a substantial impact on their efficacy. Bone marrow (BM) and adipose tissue (AT) were the most common sources of autologous MSCs.

Low MHC molecule expression on the cell surface, ease of handling and in vitro replication, genetic stability, and multilineage differentiation potential are just a few of the numerous benefits that might make BM-MSCs suited for therapeutic use. shown in (Fig. 1).

Several studies found that locally transplanted BM-MSCs were effective in treating perianal fistulas in CD patients [16, 19-21]. Intrafistular injections of autologous BM-MSCs were well tolerated and efficacious in the repair of 10 CD patients' actively draining, complicated, perianal, and enterocutaneous fistulas. Over the course of a month, all patients got 20,106 autogenous BM-MSC injections with no negative effects. AT-MSCs and BM-MSCs are given systemically to IBD affected role and show complete healing of the rectal mucosa as well as a substantial improvement in the Crohn's disease activity index. Inflammatory cytokine production (IFN-, TNF-, and IL-6) by immune cells may be inhibited, resulting in BM-MSC immunological responses. Immune cells are also stimulated by BM-MSCs to secrete anti-inflammatory chemicals such as TGF, IL-10, and VEGF, which all promote angiogenesis, tissue repair, and regeneration. AT-MSCs also have good immune-regulatory capacities, reducing T-cell production and hence lowering T-cell proliferation. Th17-expressing Th1 and RORT, as well as IL-12 and TNF, release inhibition in protected cells [22].

In 70% of BM-MSC-treated CD patients, the perianal disease activity index (PDAI) and the CDAI were seen. Furthermore, in the inflammatory portions of the wounded colons, a considerably as huge number of guts infiltrating Tregs was seen, leading to the reduction of ongoing inflammation.

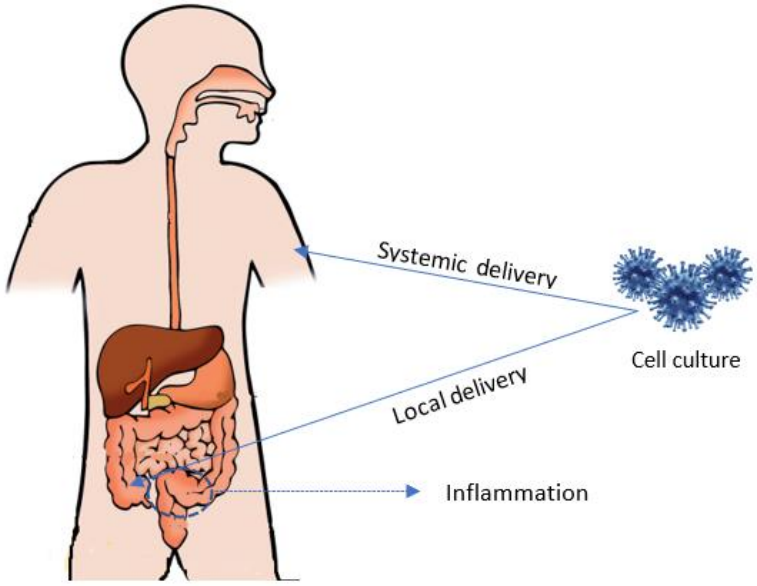

Figure 1: AT-MSCs and BM-MSCs have therapeutic promise in the conduct of IBD-affected roles.

Given that obtaining BM-MSCs necessitates the reaping of BM, which is a very offensive technique, alternate bases of MSCs, such as AT, have been vigorously investigated. AT-derived MSCs (AT-MSCs) are more readily retrieved after IBD affected role by suction lipectomy than BM-MSCs and are frequently obtained in bigger numbers. Furthermore, AT-MSCs exhibit significant immunomodulatory capabilities, allowing them to decrease the development of Th1 and Th17 cells in the gut while also promoting the proliferation of immunosuppressive Tregs (Figure 1).

Autologous AT-MSCs, like BM-MSCs, successfully repaired fistulas in CD patients. Six AT-MSC-treated CD patients had fistulas entirely cured after a single intrafistular transplantation of 3-30x106 autologous AT-MSCs, while an extra two-CD patient who received AT-MSCs had partial closure of perianal fistulas. During a 22-month follow-up, CD patients reported any adverse effects from MSC-created treatment. In phase II clinical study, the therapeutic potential of locally administered AT-MSCs was verified, with fistula repair occurring in 17 of 24 CD patients. The quality of life of all CD-affected roles who conventional AT-MSCs has improved significantly [19].

Two recent clinical investigations [23, 24] revealed the favorable benefits of autologous AT-MSC-based therapy of fistulizing CD, which corroborate our findings. AT-MSCs intralesionally healed their perianal fistulas completely without any symptoms of drainage or inflammation.

Despite the fact that the ideal amount of MSC to completely seal the fistula has yet to be discovered, practically all clinical studies have used a consistent schedule of MSC administration to CD fistula patients. All clinical studies have shown that MSC-mediated fistula healing lasts at least a year, the representative that MSCs container regarded as innovative beneficial mediators in cell-based sinus closure [25].

VI. In the Treatment of Inflammatory Bowel Illnesses, Stem Cells Administered Intravenously Have Therapeutic Benefits

In some clinical studies including MSCs for the treatment of severe inflammatory bowel disease, systemic delivery of BM-MSCs has to be used. In a phase II study, nine patients with moderate to severe CD were trialed to give an intravenous injection of 2,102 or 8106 BM-MSCs/kg body weight. The result is that only one patient treated with BM-MSC achieved complete clinical remission, while five individuals experienced unfavorable side effects after intravenous MSC infusion [26].

When CSCs are transplanted into the gut, large levels of IFN- and TNF polarise into immunosuppressive cells, which limit damaging intestinal immune responses and reduce chronic intestinal inflammation. MSCs develop a pro-inflammatory phenotype and release a significant number of inflammatory mediators if IFN and TNF receptors do not provide adequate intracellular signals (IL-1, IL-6, and IL-8) [27].

The idea that a high amount of IFN- boosts MSC therapeutic potential in vitro and in vivo has been proven. In vitro suppression of secondary blood mononucleate cells and T lymph cells were achieved by pre-treating human BM-MSCs with IFN-. In their peripheral lymphoid organs, rats given along with IFN-primed MSCs got considerably more Tregs and significantly fewer Th1 and Th17 cells than mice treated with IFN-non-ready MSCs [23, 24]. When IFN-priming MSCs, a difficulty arises because this cytokine has a tendency to boost the production of MHC grade 1 and 2 proteins, with cost molecules, on the MSC surface. According to our investigation, if MHC-mismatched patients were given mesenchymal stem cells that had been primed with IFN-, allogeneic immune responses would be substantially stronger than non-IFN-stimulated stem cells, resulting in allogeneic MSC rejection, as seen in Figure 2.

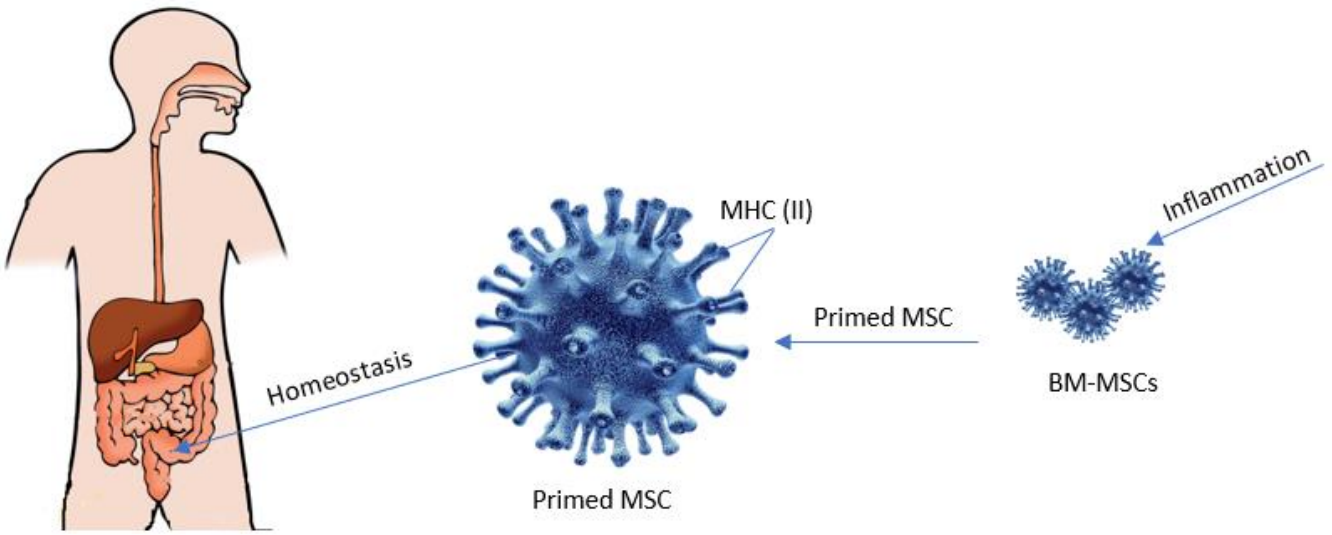

Figure (2): indicates that the IFN-γ undercoat of CSCs meaningfully improves the immunosuppressant capabilities of BM-MSCs.

VII. MSC-Based Therapy for IBDs Faces a slew of Obstacles

Results from previously completed clinical studies revealed a number of obstacles that must be overcome in order to safely and effectively transplant MSCs into IBD patients.

First, future clinical studies should thoroughly examine the relationship between transplanted MSCs and immunosuppressive medications. In IBD patients, the majority of presently utilized immunomodulatory medications suppress the Th1 immune response, resulting in lower stages of IFN- in the wounded stomach. MSCs have a provocative character once they insert the milieu through low levels of IFN-, patients who receive MSCs in conjunction with medications that inhibit the protected reaction might anticipate a worsening of IBD. Lindsay and associates recently proposed this idea after seeing an elevated prevalence of severe gastrointestinal infections followed by disease aggravation in IBD patients who had cyclophosphamide immediately before stem cell transplantation [28].

After all, because of their multilineage isolation capacity, the MSCs may develop keen on undesirable cell varieties after engraftment, which severely limits their therapeutic application in the treatment of IBD. Moreover, to undesired variation, transplanted MSCs can decrease antitumor immunity and produce neovascularization, which tumor cells may exploit to proliferate and disseminate unhindered in tissues far from the MSC transplantation site

VIII. Conclusion

Cancer stem cells are emerging therapeutic agents in cell-based therapy for inflammatory bowel diseases due to their immunomodulatory and regenerative properties. Intralesional transplantation of autologous CSCs may be considered as a safe and effective treatment method for repairing perianal fistulas in CD patients, according to a large number of randomized clinical studies. Safety concerns have been raised regarding the systemic administration of MSCs. However, since multiple clinical studies have revealed an aggravation of IBD once a venous combination of MSCs, MSCs systemic can provide a rather safe treatment modality.

Because cancer stem cells can distinguish into unwanted cell categories plus aid tumor growing plus evolution, medical revisions looking into the therapeutic possibility of stem cells would focus on stretched-term monitoring and continuation of affected roles who have received MSC transplants to identify all potential side effects. MSC-based therapy is a promising treatment option. More experimental and clinical research is needed to discover the optimum source of tissue, cell quantity, and administration strategies before MSCs can be utilized as conventional therapy for IBD.

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Issue Highlights

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International Journal of Engineering and Applied Computer Science
Volume: 04, Issue: 01, February 2022
ISBN: 9798425593016