Mathematical Model on Various Parameter of Skin Diseases and Role of Immune System on that.

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Abstract

Skin is the essential organ as it protects the human body from external aggressions and pathogens. The skin having a network of cells which form theskin immune system. Which act as a passive protective barrier andplay the important immunological role.Details study of various diseases according to seasons and various parameters of skin diseasesdiscussed in this paper. Skin diseases of specific region of Maharashtra has been taken for more detail studies.Mathematical modelform on related data.In this papermathematical modellingincrease our understanding of skin.

Keywords-Immune system, skin diseases, parameters.

Introduction: In all living things immune system is most essential and most important for the survival. Without an immune system, our body cannot be stand for survival. Our immune system protects us from the viruses, pathogens and keep us healthy. The immune system clears up dead cells and continuouslyfight with the pathogens.

In human body skin is very important sensitive organ as it's always protected the human body from the pathogens and external barrier. Skin immune system consist of the huge network of cells which helps to protect the body from external barrier.

Various parameter was discussed in [1],[4][8] due to which diseasesoccurred and form the mathematical model on way of spreading the diseases. In this paper we have discussed various types of the skin diseases and various parameters responsible for it, Skin diseasesaccording to the environment and season, why skin diseases occurs, role of immune system and how to overcome the disease .Various lab test are there for skin diseases like skin culture, in thatby taking a sample of skin by scraping skin,by swabbingor removing a small piece of skin or by taking a blood sample for testing purpose one can identify the type of skin disease and infection. Various parameters related to skin disease like environment, season, temperature, water content, age we have discussed in this paper. We have tried to plot the graph representing the relationship between the age of the person and number of patients related to the skin diseases. Viswantha Reddy Allubunti form a mathematical model for skin cancer disease by using machine learning process [2].Olga Byadoyskayadiscussed the lumpy skin diseases and form the mathematical model on how it was spreading [3]We have formed the mathematical model by using correlation analysis by studying correlation analysis of temperature and precipitation [5].

The immune system would normally produce antibodies, proteins that react against toxins viruses, bacteria.Sunlight contains an ultra violet radiations which trigger an autoimmune response. Some skin diseases occur due to auto immunity. Dry skin in Sjogren's syndrome

can occur as a result of an autoimmune attack on the lubricating moisturizing and mechanisms of the skin, which involves hair, sweat glands, and oil glands. Various diseases occur in various season discussed as follow.

 Winter skin diseases-As the weather begins to cool down, skin can react negatively to the seasonal change and might develop one of the following common winter diseases.

1)Eczema-It can be exacerbated in the winter due to the dry/cold air**.** It is an inflammatory skin disorder that results in red, dry itchy skin. Its symptoms include red/brown patches on the skin, itchy skin, sensitive skin, Dry skin, small, raised bumps, and thick/scaly skin.to preventEczema anti-rash, moisturizing cream, anti-itch, and gentle skin cleansing products product are referred to the patients.

2)Raynaud's Disease-It causes numbness in the toes and fingers during cold temperatures Symptoms include, colour changes in fingers and toes, numbness, or stinging pain or cold fingers and toes. Its treatment includes wearing socks & gloves to prevent exposure to the cold, and in more severe cases medication can be prescribed to increase blood flow and expand arteries.

3) **Psoriasis** is an autoimmune disease which causes red skin, scaly patches that appear on the skin. Its symptoms included scaly patches, cracked skin, red skin patches, skin tenderness, burning, and swollen/stiff joints.

4)Cold Urticaria is an allergic reaction to the cold. Symptoms include temporary hives on the exposed area, swelling of hands when touching cold objects, and swelling of lips when consuming cold foods/drinks.

5)**Winter Rash-** due to the dry and cold air skin becomes irritated, red, or itchy scaly.
skin tenderness occurs in the winter season. For treatment of winter rashes moisturizers or cortisone creams are used generally.

Summer skin diseases- The sun can have a damaging effect on our skin and it cause various skin problems. Here are the most common summer skin problems.

1. Acne-Several factors contribute to an outbreak of acne like sweating due to the heat, pores being open, due to the dirt and oil on hands from being outside.Due to all these three things, an acne outbreak. When we are outside and when we touch sweaty face, germs and bacteria stick to the skin, and as pores are open impurities flood pores get trapped inside and become acne.

To overcome through this problem, we should stay hydrated. Sweat helps oils and dirt stick around, so washing them will lower the chances of getting an outbreak of acne. Washing hands and face regularly will keep from transferring bacteria from hands to face and clogging pores. Similarly washing of sweaty clothes and accessories before wearing them again, applyingmoisturizer, use of oil-free products and products that don't clog pores.

2. Dry Skin

The sun is very good at wicking away moisture from surfaces and that includes our skin. This is why we often feel dry and brittle after spending some time in the sun.

As a solution on that keep skin hydrated and moisturizedwhich can lose the drying effect of the sun. After swimming take a shower and shampoo your hair to get rid body and hair from any impurities and chemicals that may further dry your skin. Apply a generous amount of moisturizer. This will help skin lock in the moisture. As a preventative measure, one can use a moisturizing sunscreen which protect skin from the sun's harmful rays and also moisturize the skin.

3) Folliculitis

Folliculitis is a condition in which hair follicles become infected. Appearing as pimples, these infected follicles become itchy and sore to the touch.

How to fix it: Folliculitis can be treated at home if the symptoms are mild. Applying a warm, wet cloth to the area can help relieve the symptoms and possibly drain the bumps.Useof hydrocortisone creams helps to relieve the itching.Antibiotics are also used to help the infection clear up. If symptoms are more severe, doctors can provide medication. It would also be wise to refrain from shaving or do anything that may further irritate the skin.

4) Melasma

Melasma is another skin condition brought on by overexposure of the sun. Melasma is the term for the brown or grey sunspots that appear on face and neck.The sun harmful UV rays affect the pigmentation in our skin called melanin. Melanin is responsible for protecting our skin from the sun, so when we get too much of it, melanin kicks into overdrive and floods certain areas, causing that area to appear darker.

Solution-Melasma can easily be treated with a cream called hydroquinone. Hydroquinone is a skin-bleaching agent that lightens the skin when applied routinely.

5) Prickly Heat (Heat Rash)

When sweat glands are blocked for an extended period of time turns into the heat rash.Itchy like feeling when one is wearing hot and tight clothes. It is called as prickly heat. The trapped sweat creates a rashand buildsalong with small bumps, the bumps will burst, giving way to locked in sweat and cause the prickly sensation.

How to solve the problem: Minimizing sweat secretion related efforts, wearing breathable loose, clothing can helpto completely avoid prickly heat. Avoid to go outside when it is extremely hot.

6) Hives from Sun Allergy

Sun allergy is naturalsome people develop an allergy due to the sun.But for many peoples, it is often a reaction brought on by a particular medication they are taking. A mild allergy may result inred, dry, scaly skinhives, a breakout of severely itchy bumps.

How to solve this problem,if you know your medication may cause hives, avoid direct sunlight, wear sunscreen and wear protective clothing including sunglasses, hats, sun coats scarfs.Cool compress and medications like antihistamines can help to alleviate symptoms due to Sun allergy. Sometimes hives typically go away on their own.

7) Sunburn

Sunburn is probably the single most common skin condition experienced during the summer. It occurs when we spend too much time with sun and skin absorbing harmful UV rays. These rays, over time, essentially burn our skin and will cause our DNA to mutate which opens the door for skin cancer.

To solve the problem of sunburn one should make wearing sunscreen a habit. Every time you go outside, apply sunscreen. Sunscreen not only limits your chances of being sunburned, but it also protects body from developing the skin cancer. One can apply the aloe Vera gel as a solution on skin burn, or other commercial ointments containing aloe, to the sunburnt area. This willsoothe the burning sensation and helps to fast recovery. If the pain is too much,we can take simple painkillers to relieve the pain.

All above are some skin diseases which are generally occur in every regionsuffer by all the age of the people.

STATISTICAL MODELING OF SKIN IMMUNE DISORDER

To study the skin disease deeply we have chosen Nagpur region in Maharashtra. Nagpur which is called as orange city famous for its sweet oranges. Nagpur is situated at the centre of the country, as zero-mile stone is located in the city. One of the most common factors for causing the skin diseases is the Climate change which is changing continuously. In this paper we have studied some parameters of the environment due to which skin diseases occur, Parameter such as temperature, watercontent, heat waves. Etc, all have been linked to the infectious skin disease outbreaks.

Data collected from the hospital in Nagpur for the survey, Allthe patients attending the Dermatology in the Hospital from January 2020 to December 2020 were included in this analysis (Table 1). The medical records of the patient's history, physical examination and laboratory investigations were analysed to ascertain the diagnosis and the management of cases. All patients were evaluated by qualified dermatologist. Following table shows the distribution of various diseases according to various season occur in India.

Common skin disorders	Spring (%)	Summer (%)	Autumn (%)	Winter (%)	Average
Dermatitis	19.8	16.8	20.8	21.6	19.75
Urticaria	16.7	12.6	18.3	15.8	15.85
Insect Bites	8	14.9	13.2	7.8	10.98
Fungal Infections	8	10.8	12.4	7.5	9.68
Bacterial Infections	7.2	5.2	4.6	8.5	6.38
Viral Exanthemas	4.1	6.4	5.7	5.2	5.35
Pruritus	5.0	4.3	8.6	7.5	6.35
Others	31.2	29.0	16.2	26.1	25.68
Total	100%	100%	100%	100%	

Table 1: Distribution of skin disorder with relation to seasons.

Weather report of Nagpur division-The Nagpur city has a tropical savannah climate, typically hot, dry and tropical weather with an average annual rainfall of 1018 mm, where

summer temperature escalates to 48⁰C and the winter temperature dips to 10 -12⁰.Table 2 contains the weather report according to season and table

3 contains the monthly weather report of Nagpur regiontaken from reference [6].

Spring	Summer	Autumn	Winter
17-33 DC	41-48 DC	23-32DC	10-12 DC

Table 2: Nagpur Weather report season wise for the year 2020

Months-	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	21.1 °C (69.9) °F	24.3 °C (75.8) °F	28.5 °C (83.3) °F	33.1 °C (91.6) °F	35.6 °C (96.1) °F	31.3 °C (88.3) °F	26.7 °C (80.1) °F	26.4 °C (78.9) °F	27 °C (80) °F	26.1 °C (78.9) °F	23.7 °C (74.7) °F	21.2 °C (70.1) °F
Min. Temperature °C (°F)	14.5 °C (58.1) °F	17.5 °C (63.5) °F	21.2 °C (70.2) °F	25.7 °C (78.2) °F	29.5 °C (85) °F	27.3 °C (81.2) °F	24.5 °C (76) °F	23.9 °C (75) °F	23.6 °C (74.5) °F	21 °C (69.8) °F	17.5 °C (63.6) °F	14.7 °C (58.4) °F
Max. Temperature °C (°F)	27.7 °C (81.9) °F	31.1 °C (88) °F	35.5 °C (95.8) °F	40 °C (103.9) °F	41.7 °C (107) °F	35.8 °C (96.4) °F	29.6 °C (85.4) °F	29 °C (84.1) °F	30.4 °C (86.7) °F	31.3 °C (88.3) °F	29.7 °C (85.5) °F	27.7 °C (81.9) °F
Precipitation / Rainfall mm (in)	14 (0.6)	12 (0.5)	17 (0.7)	8 (0.3)	13 (0.5)	169 (6.7)	355 (14)	309 (12.2)	168 (6.6)	46 (1.8)	11 (0.4)	6 (0.2)
Humidity (%)	47%	41%	31%	24%	25%	52%	79%	83%	78%	62%	53%	49%
Rainy days (d)	1	2	2	2	2	10	17	17	12	4	2	1
avg. Sun hours (hours)	9.5	10.1	10.7	11.3	11.8	10.7	8.2	7.6	8.7	9.7	9.6	9.5

Table 3: Nagpur Weather report for the year 2020

Minimum maximum temp in Nagpur (Monthly)

Sr.No	Months	Season	Min Temp (dc)	Max Temp(dc)	Average Temp (dc)
1	January	Winter	14.5	27.7	21.1
2	February	Spring	17.5	31.1	24.3
3	March	Spring	21.2	35.5	28.5
4	April	Summer	25.7	40	33.1
5	May	Summer	29.5	41.7	35.6
6	June	Summer	27.3	35.8	31.3
7	July	Rainy	24.5	29.6	26.7
8	August	Rainy	23.9	29	26.4
9	September	Autumn	23.6	30.4	27
10	October	autumn	21	31.3	26.1
11	November	winter	17.5	29.7	23.7
12	December	winter	14.7	27.7	21.2

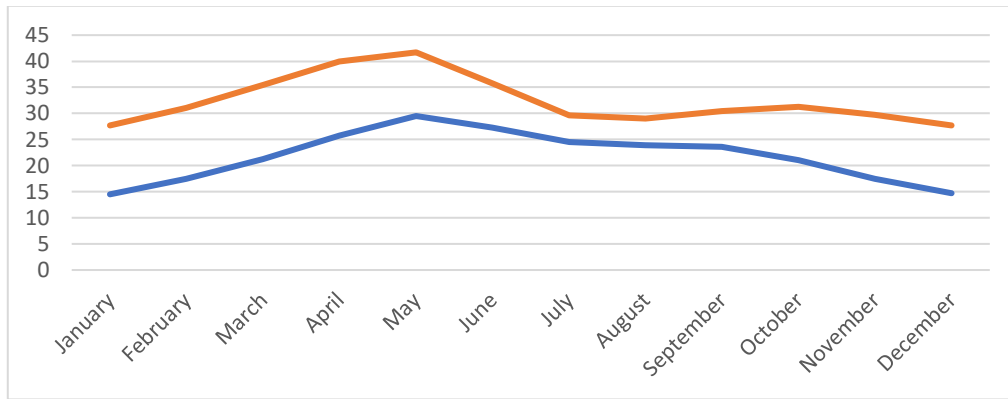**Table 4: Minimum maximum temp in Nagpur**

Fig 1: Graph of temperature per month in Nagpur region

To find coefficient of correlation between the skin disease dermatitis and one of the parameters due to which skin diseases occur that is temperature has been taken (table 5).

skin diseases (percentage of dermatitis occur according to season) x	21.6	19.8	19.8	16.8	16.8	16.8	16.8	20.8	20.8	20.8	21.6	21.6
Average of monthly temp (say y)	21.1	24.3	28.5	33.1	35.6	31.3	26.7	26.4	27	26.1	23.7	21.2

Table 5: Percentage of dermatitis diseases according to seasons

To find the coefficient of correlation between x& y above data tabulated as follow.

Sr.No.	skin diseases (percentage of dermatitis occur according to season) (x)	Average of monthly temp(y)	x^2	y^2	xy
1	21.6	21.1	445.21	466.56	455.76
2	19.8	24.3	590.49	392.04	481.14
3	19.8	28.5	812.25	392.04	564.3
4	16.8	33.1	1095.61	282.24	556.08
5	16.8	35.6	1267.36	282.24	598.08
6	16.8	31.3	979.69	282.24	525.84
7	16.8	26.7	712.89	282.24	448.56
8	20.8	26.4	696.96	432.64	549.12
9	20.8	27	729	432.64	561.6
10	20.8	26.1	681.21	432.64	542.88
11	21.6	23.7	561.69	466.56	511.92
12	21.6	21.2	449.44	466.56	457.92
	Average		**9021.8**	**4610.64**	**6253.2**

Table 6: Calculations

From above table 6, required values are;

$\sum x^2 = 9021.8 \sum y^2 = 4610.64 \sum xy = 6253.2$

Coefficient of correlation is given by

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}} = \frac{6253.2}{\sqrt{9021.8 \times 4610.64}} = \frac{6253.2}{6449.14} = 0.9696$$

$$\boxed{r = 0.9696}$$

Which is the correlation between the temperature and a percentage of a skin diseases dermatitis**.**

Result:

From above calculation it is interpreted that there is correlation between percentage of diseases and temperature. As temperature is increases there is increase in the particular diseases and vice versa. We can find the correlation between other diseases and the temperature. Immune system plays an important role to occur and not to occurred a particular disease. Diseases occurred when there is lack of nutrients in the body. If we increase the amount of that particular nutrient, minerals vitamins in the body by using natural way or by using proper medicine we can overcome the skin diseases [6]. We have taken data of more than 1000 patient who attended the dermatology clinic. Patients are from the range of the years 21years to 40 years.Allergic skin diseases, mostly dermatitis and urticaria (35.7%) where the most common skin diseases occur in the patients [9].Infectious diseases (26.1%) and insect bites percentage is (10.1%).Inflammatory and autoimmune disorders accounted for 7.9% of the cases.It has been concluded that the climate change is responsible for the region-specific increases in skin.

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