# Hair Loss Diagnosis and Treatment Expert System

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**Abstract:** *Though hair loss (alopecia) is not a debilitating or life threatening sickness, the very thought of becoming bald can lead to emotional stress and traumatic experience for those who suffer from premature or excessive hair loss. Many will try anything and everything to bring back their locks. Or at least, some of their once full head of hair. Hair loss sufferers spend billions of dollars annually on remedies ranging from drugs, vitamins to special tonics and shampoos. Conventional treatments of hair thinning includes drugs therapy and hair transplant. Minoxidil and Propecia (Finasteride) are the only two drugs approved by the FDA for hair growth in men. Minoxidil is the only drug available for women with and rogenetic alopecia. These drugs have been proven to show positive results for balding conditions on the vertex region of the scalp. Though these drugs are effective, many are wary of their unknown long-term effect and potential side-effects. This has led to increase interest in alternative remedies such as herbal medicine.*

**Keywords:** Hair loss, Herbs, Herbal medicine

## 1. INTRODUCTION

Hair loss is the thinning of hair on the scalp. The medical term for hair loss is alopecia. Alopecia can be temporary or permanent. The most common form of hair loss occurs gradually and is referred to as "androgenetic alopecia," meaning that a combination of hormones (androgens are male hormones) and heredity (genetics) is needed to develop the condition. Other types of hair loss include alopecia areata (patches of baldness that usually grow back), telogen effluvium (rapid shedding after childbirth, fever, or sudden weight loss); and traction alopecia (thinning from tight braids or ponytails)[1-5].

**Hair Structure:** Hair is composed primarily of proteins (88%). These proteins are of a hard fibrous type known as keratin. Keratin protein is comprised of what we call "polypeptide chains." The word, polypeptide, comes from the Greek word "poly" meaning many and "peptos" meaning digested or broken down. In essence, if we break down protein, we have individual amino acids. Many (poly) amino acids joined to get her form a "polypeptide chain". Two amino acids are joined together by a "peptide bond", and the correct number of amino acids placed in their correct order will form a specific protein; i.e. keratin, insulin, collagen and so on. The "alpha helix" is the descriptive term given to the polypeptide chain that forms the keratin protein found in human hair. Its structure is a coiled coil. The amino acids link together to form the coil and there are approximately 3.6 amino acids per turn of the helix (coil). Each amino acid is connected together by a "peptide bond". The peptide bond is located between the carbon atoms of one amino acid extending to bond with the nitrogen atom of the next amino acid [6-24].

**The Hydrogen Bond**: The first bond is the hydrogen bond. This bond is located between the coils of the alpha helix and is responsible for the ability of the hair to be stretched elasticity) and return back to its original shape. The hydrogen bonds allow us to change the shape of the hair temporarily with the aid of water. These bonds are electrolytically controlled and are the most readily broken down and the most readily reformed. These bonds are responsible for approximately 35% of the strength of the hair and 50% of the hair's elasticity (some would argue up to 99.9% of the hair's elasticity) [6-24].

**The Salt Bond**: The salt bond is also an ionic (electrolytically controlled) bond formed by the electron transfer from the side chain of a basic amino group (an amino acid with an coo- group) to the side chain of an acidic amino acid, i.e. NH3+. (This is two positive and negative charges attracting one another.) This occurs in a position paralleled to the axis line of the rotation of the helix of the hair. The salt bond is responsible for approximately 35% of the strength of the hair and 50% of the hair's elasticity[6-24].

**The Cystine Bond** : The cystine bond also known as the disulfide bond, sulfur bond, or just S bond is formed by cross-links between cystine residues (amino acids) of the main polypeptide chains. This bond is perpendicular to the axis of the hair and between the polypeptide chains. Because of its position in the hair, it is responsible for the hair's toughness or abrasion resistance. (It actually holds the hair fibers together.) These cross-links are frequent in the hair fiber, with maximum of frequency of one cystine bond every four turns of the alpha helix. This is what enables us to permanent wave the hair [6-24].

**The Sugar Bond**: The sugar bond is formed between the side chain of an amino acid having an OH group and an acidic amino group. This bond is also formed perpendicular to the axis of the hair. Because of its position, it gives the hair toughness but little strength (5%). Some moisture is contributed to the hair as a by-product of this bonding [6-24].

**Hair Loss Causes**: Hair loss causes are a quite controversial issue as there is no general agreement about what are the main factors that cause loss of hair. Some scientists consider the male hormone testosterone to be one of the major hair loss causes. Testosterone is closely connected with heredity. If a man has inherited the necessary genes for loss of hair, a little of testosterone is formed by some of the hair roots into a derivative called dihydrotestosterone. And in fact, it is dihydrotestosterone that is responsible for hair loss. So dihydrotestosterone is present in the surface sebum of hereditably predisposed people. When a hair is shed it enters the follicle reacts inside there chemically. Dihydrotestosterone miniaturizes the hair root and follicle and the new hair growing through it will be finer. When the new fine hair is later shed dihydrotestosterone again miniaturizes the follicle and hair root and so on until baldness occurs. Thus, male hormones, precisely, testosterone, are sponsoring baldness. Actually, male hormones start "working" when a man is sexually mature, so there's little danger of hair loss before puberty. Another point of view that is to some extend opposed to the theory of inherited disposition is focuses attention on the blood flow. So it is not testosterone and male hormones that are considered to be the main cause of hair loss but a poor blood flow to the scalp, insufficient nutrients in blood and poor drainage of waste products through the lymphatic systems. Considering this opinion as a prevalent on presupposes appropriate ways of treatment that center around the increase of the blood flow in the scalp. Loss of hair in men and women is also considered to be caused by excessive oil in the scalp. This oil, that is also called sebum, clogs the pores of the scalp and stifles follicle growth. In time the hair root is asphyxiated, making it impossible for new hair to grow. If the scalp is not cleaned properly sebum becomes wax that clogs the pores. Thus, the new hair cannot come out. A few hairs that manage to push through this wax is so weak that they are ready to fall out at any time. These three factors are the most common ones. Among other hair loss causes there are also the following [6-24]:

- Emotional strains,
- stresses
- nervous disorders
- Aging,
- Infections,
- Hormonal imbalance,
- Polluted environment,
- Toxic substances,
- Injury and impairment,
- Radiation.

It is normal to lose between 50-100 hairs a day, this is part of the hair renewal process. However most people suffer from excessive hair loss at one time in their life. There are many reasons for this including medication, radiation, chemotherapy, and exposure to chemicals, hormonal and nutritional factors, thyroid disease, generalized or local skin disease, and stress. Many of these causes are temporary and a few are permanent. These are some of the more common reason for hair loss.

**Alopecia Areata**: This type of hair loss is believed to be caused by the immune system reacting to hair follicles as if they were antibodies and shutting them down. The hair loss is usually limited to a coin sized area and all the hair in the area is lost leaving a totally smooth round patch. In a more severe rarer condition called Alopecia Totalis, all hair on the entire body is lost, including the eyelashes. Treatments include topical medications, a special kind of light treatment, or in some cases drugs.

**Stress: Stress** can cause hair loss is some people. Usually it occurs 3 months after the stressful event has occurred and it may take 3 months after the stress period has ended for the hair growth to resume. In most cases it is temporary if the person is not predisposed to genetic or Androgenic Alopecia, if they are stress may trigger the onset of genetic hair loss.

**Ginkgo Biloba**: Ginkgo Biloba is a very popular herbal remedy that is thought to help with many problems, among them improving the circulation of blood to the brain and skin. The majority of herbalists who prescribe this for loss of hair do so believing that the increase of blood to the brain and skin delivers more nutrients to the hair follicles and so promotes hair re-growth.

**Green Tea (Camellia Sinesis)** : Green tea is another popular herbal remedy as it is believed that the enzyme 5-alpha-reductase is inhibited by the catechins found in the green tea. Some herbalists claim that you will reduce the risk of male pattern type baldness if you drink several cups of green tea or take it in capsule form on a daily basis.

**Saw Palmetto (Seranoa Repens)** : Saw palmetto is a very popular choice among with hair loss; this is due to the fact that it also has the ability to protect the prostrate. Not only does it encourage the hair to re-grow but it also slows down the loss of hair.

## 2. MATERIALS AND METHODS

The proposed expert system performs diagnosis for eleven different possible hair loss diseases of the stages between human lives starting with children to adults by asking Yes or no questions. The proposed expert system will ask the user to select the correct answer in each screen. At the end of the dialogue session, the proposed expert system provides the diagnosis and recommendation of the disease to the user. Figure 1 shows the starting screen of the expert system, figure 2 shows a sample dialogue between the expert system and the user, and figure 3 shows how the users get the diagnosis and recommendation of the expert system.
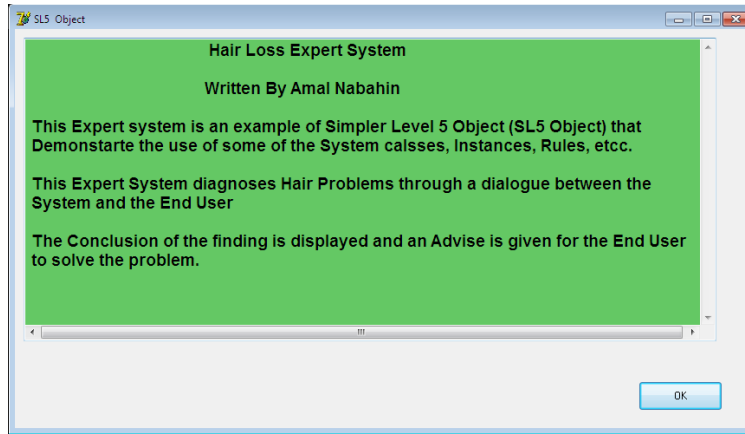


**Figure 1:** The figure shows the starting screen of the expert system.
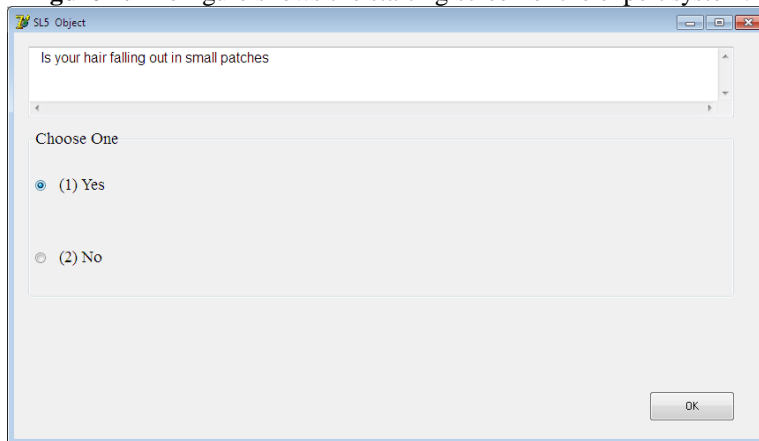


**Figure 2:** The figure shows when the system asks the user.
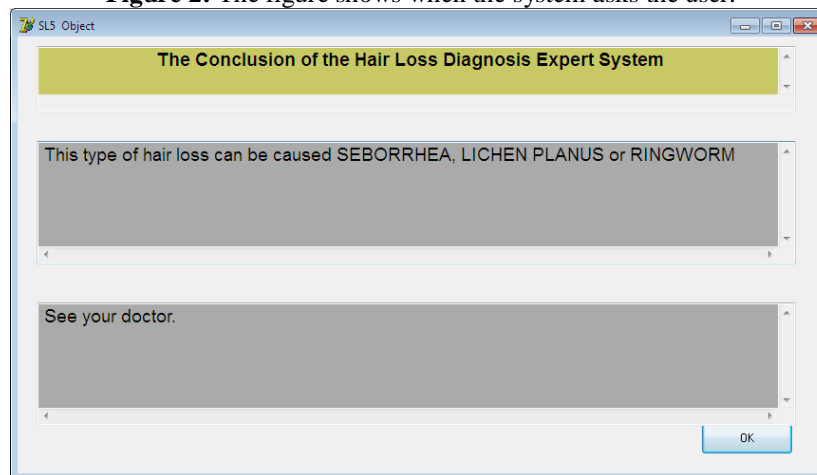


**Figure 3:** The figure shows diagnosis and recommendation of the expert system.

## 3. LITERATURE REVIEW

There are a lot of Expert Systems that were designed to diagnose diseases such as Eye, Endocrine, skin and other types of disease [26]-[56]. But there is no specialized expert system for diagnosis of hair loss in children and adults diseases available free. MYCIN is a very famous expert system for diagnosing bacterial infections in the blood [58]. Some of these expert Systems are specialized in one specific disease, but the current proposed expert system is specialized in the diagnosis of eleven hair loss in children and adults diseases.

## 4. KNOWLEDGE REPRESENTATION

This expert structure to help hair loss specialist, pediatrician, starting late graduated specialist, and for children's people with hair loss problems, with a particular true objective to embrace the correct treatment [5]. expert System is a PC utilizing Artificial Intelligence [26-28]; which contains a knowledge base and an inference engine ; the guideline fragments and unpretentious components are addressed in figure 4.
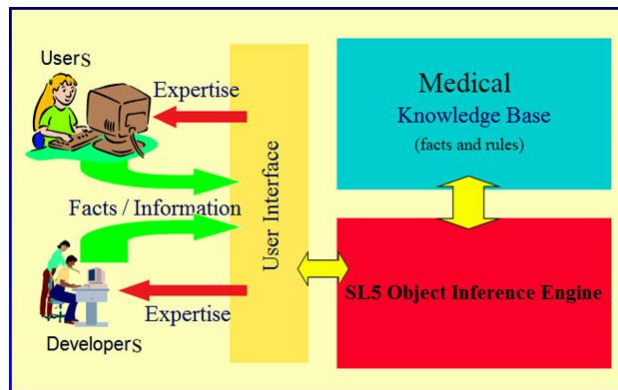


**Figure 4:** The figure presents the Main Components of Typical Expert System.

The proposed Expert System for hair loss in children and adults Diseases Diagnosis was executed utilizing, SL5 Object dialect which is short for Simpler Level 5 Object [25]. It is a forward chaining reasoning master framework that can make deductions about realities of the world utilizing tenets, protests and take proper activities accordingly. The SL5 Object expert systems language is written in Delphi Embarcadero RAD Studio XE6 [57]. SL5 Object executes any Expert System like frames. It's simple for the information architect to assemble the Expert System and for the end clients when they utilize the system.

The master sources of the knowledge for this expert system are hair loss in children and adults diseases and specializes websites for hair loss in children and adults diseases. The captured knowledge has been transformed into SL5 Object Knowledge base syntax (Facts, Rules and Object)[25].  SL5 Object expert systems language is very easy to use and has user friendly interface. Currently the expert system has seven rules which cover eleven hair loss in children and adults diseases.

## 5. DECISION TREE FOR THE KBS FOR HAIR LOSS DIAGNOSIS
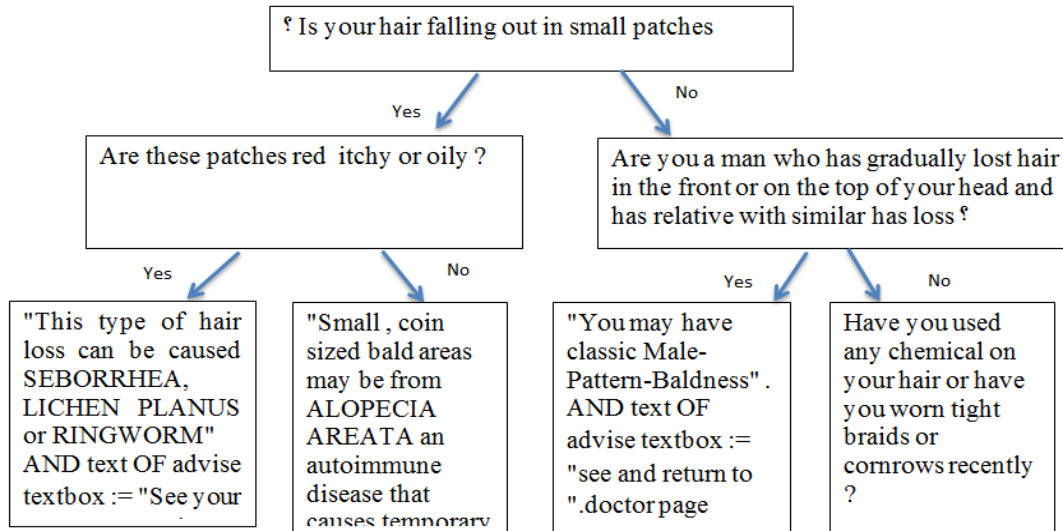
## 6. CONCLUSION

Hair loss is not just a cosmetic problem but psycho-sociological problem also. Androgen antagonism, potassium channel opening, Angiogenesis (through endogenous substances) and 5-alpha reductase inhibitions are the major non-surgical therapeutic strategies for hair growth promotion. Exploring the herbal drugs for the promotion of hair growth is the vital need of this era. The potential of end number of herbal drugs in hair growth promotion has been studied. But still more scientific documentation of herbal/ayurvedic drugs is needed for the same. This can be attained by careful and accurate characterization of the active phytoconstituents, elucidation of molecular mechanism of their actions, demonstrations of the real efficacy by in vivo studies on proper animal models of hair loss and finally by demonstration of their safety and effectiveness in clinical trails.

## 7. EXPERT SYSTEM SOURCE CODE

```
!Written by Amal Nabahin
!
ATTRIBUTE Is your hair falling out in small patches ? COMPOUND
Yes , No
ATTRIBUTE Are these patches red itchy or oily ? COMPOUND
Yes , No
ATTRIBUTE Are you a man who has gradually lost hair in the front or on the top of your head and has relative with similar has loss? COMPOUND
Yes , No
ATTRIBUTE Have you used any chemical on your hair or have you worn tight braids or cornrows recently ? COMPOUND
Yes , No
ATTRIBUTE Are you talking any new medicine or are you being treated for cancer ? COMPOUND
Yes , No
ATTRIBUTE HAVE you been weak tired  or anxious? COMPOUND
Yes , No
ATTRIBUTE Are you a woman who is older than 50 or who has given birth within the last three months? COMPOUND
Yes , No

ATTRIBUTE start SIMPLE

INSTANCE the domain ISA domain
    WITH start := TRUE

INSTANCE the application ISA application
```

```
 WITH title display := introduction
 WITH conclusion display :=  Conc
 WITH numeric precision := 8
 WITH simple query text := "Is it true that:
*
is
"*
  WITH numeric query text := "What is(are:(
*
of
"*
  WITH string query text := "What is(are:(
*
of
"*
  WITH time query text := "What is(are:(
*
of
"*
  WITH interval query text := "What is(are:(
*
of
"*
  WITH compound query text" =:
*
of
"*
  WITH multicompound query text := "What is(are:(
*
of
"*
INSTANCE introduction ISA display
  WITH wait := TRUE
  WITH delay changes := FALSE
  WITH items [1 ] := textbox 1

INSTANCE textbox 1 ISA textbox
  WITH location := 10,10,800,350
  WITH pen color := 0,0,0
  WITH fill color := 100,200,100
  WITH justify IS left
  WITH font := "Arial"
  WITH font style IS bold
  WITH font size := 14
  WITH text "=:
```

<div align="center">Hair Loss Expert System</div>

<div align="center">Written By Amal Nabahin</div>

This Expert system is an example of Simpler Level 5 Object (SL5 Object) that Demonstrate the use of some of the System classes, Instances, Rules, etc.

This Expert System diagnoses Hair Problems through a dialogue between the System and the End User

The Conclusion of the finding is displayed and an Advise is given for the End User

to solve the problem".


INSTANCE Conc ISA display
  WITH wait := TRUE
  WITH delay changes := FALSE
  WITH items [1] := title textbox
  WITH items [2] := problem textbox
  WITH items [3] := advise textbox

INSTANCE title textbox ISA textbox
  WITH location := 20,10,800,70
  WITH pen color := 0,0,0
  WITH fill color := 200,200,100
  WITH justify IS center
  WITH font := "Arial"
  WITH font style IS bold
  WITH font size := 14
  WITH text := " The Conclusion of the Hair Loss Diagnosis Expert System"

INSTANCE problem textbox ISA textbox
  WITH location := 20,110,800,130
  WITH pen color := 0,0,0
  WITH fill color := 170,170,170
  WITH justify IS left
  WITH font := "Arial"
  WITH font size := 14
  WITH text"--===-- "=:

INSTANCE advise textbox ISA textbox
  WITH location := 20,280,800,130
  WITH pen color := 0,0,0
  WITH fill color := 170,170,170
  WITH justify IS left
  WITH font := "Arial"
  WITH font size := 14
  WITH text"--===-- "=:

RULE R0
IF start
THEN ASK Is your hair falling out in small patches ?

RULE R1
IF Is your hair falling out in small patches ? IS Yes
THEN ASK Are these patches red  itchy or oily?

RULE R1a
IF Is your hair falling out in small patches ? IS No
THEN ASK Are you a man who has gradually lost hair in the front or on the top of your head and has relative with similar has loss ?

RULE R2
IF Are these patches red  itchy or oily ? IS Yes
THEN text OF problem textbox  := "This type of hair loss can be caused SEBORRHEA, LICHEN PLANUS or RINGWORM"
AND text OF advise textbox := "See your doctor".

RULE R2a
IF Are these patches red itchy or oily ? IS No
THEN text OF problem textbox := "Small , coin sized bald areas may be from ALOPECIA AREATA an autoimmune disease that causes temporary hair loss"
AND text OF advise textbox := "See your doctor".

RULE R3
IF Are you a man who has gradually lost hair in the front or on the top of your head and has relative with similar has loss? IS Yes
THEN text OF problem textbox := "You may have classic Male-Pattern-Baldness" .
AND text OF advise textbox := "see and return to doctor page".

RULE R3a
IF Are you a man who has gradually lost hair in the front or on the top of your head and has relative with similar has loss?  IS No
THEN  ASK Have you used any chemical on your hair or have you worn tight braids or cornrows recently?

RULE R4
IF Have you used any chemical on your hair or have you worn tight braids or cornrows recently ? IS Yes
THEN text OF problem textbox := "You may have classic Male-Pattern-Baldness".
AND text OF advise textbox := "Over-the-counter and prescription medicines are available to treat male-pattern baldness. See your doctor. He or she will determine which treatment is right for you".

RULE R4a
IF  Have you used any chemical on your hair or have you worn tight braids or cornrows recently ? IS No
THEN ASK Are you talking any new medicine or are you being treated for cancer ?

RULE R5
IF Are you talking any new medicine or are you being treated for cancer ?  IS Yes
THEN text OF problem textbox := "Hair loss may be a side effect of MEDICINES, STEROIDS or CHEMOTHERAPY".
AND text OF advise textbox := "Discuss these treatments with your doctor".

RULE R5a
IF Are you talking any new medicine or are you being treated for cancer ?  IS No
THEN ASK HAVE you been weak , tired , or anxious?

RULE R6
IF HAVE you been weak tired or anxious?  IS Yes
THEN text OF problem textbox := "You may have IRON or ZINC DEFICIENCY, THYROID DISEASE or excess STRESS".
AND text OF advise textbox := "See your doctor".
RULE R6a
IF HAVE you been weak tired or anxious? IS No
THEN ASK Are you a woman who is older than 50 or who has given birth within the last three months?

RULE R7
IF Are you a woman who is older than 50 or who has given birth within the last three months?  IS Yes
THEN text OF problem textbox := "HORMONE CHANGES may cause hair loss in women. If your hair loss has occurred gradually with advancing age, FOLLICULAR DEGENERATION may be the cause"
AND text OF advise textbox := "Post-pregnancy hormone changes usually reverse themselves without any treatment. While follicular degeneration cannot be reversed, gentle hair care may prolong the life of follicles"

RULE R7a
IF Are you a woman who is older than 50 or who has given birth within the last three months?  IS No
THEN text OF problem textbox := ""
AND text OF advise textbox := "For more information, please talk to your doctor ."

END

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