



University of Nebraska Medical Center
DigitalCommons@UNMC

[MD Theses](#)

[Special Collections](#)

5-1-1932

Treatment of ringworm of the feet

Harry G. Williams
University of Nebraska Medical Center

This manuscript is historical in nature and may not reflect current medical research and practice. Search [PubMed](#) for current research.

Follow this and additional works at: <https://digitalcommons.unmc.edu/mdtheses>

 Part of the [Medical Education Commons](#)

Recommended Citation

Williams, Harry G., "Treatment of ringworm of the feet" (1932). *MD Theses*. 602.
<https://digitalcommons.unmc.edu/mdtheses/602>

This Thesis is brought to you for free and open access by the Special Collections at DigitalCommons@UNMC. It has been accepted for inclusion in MD Theses by an authorized administrator of DigitalCommons@UNMC. For more information, please contact digitalcommons@unmc.edu.

"TREATMENT OF RINGWORM OF THE FEET"

Harry G. Williams.

1932

"TREATMENT OF RINGWORM OF THE FEET"

Before the discussion of treatment of ringworm of the feet it is well to have some general idea as to the etiology and the pathology of the disease.

Ringworm of the feet is a fungus infection usually found between the toes or about the nails. It is technically called dermatophytosis, epidermatophytosis, epidermomycosis, trichophyton interdigitale or athletic foot. Hongkong foot, Shanghai foot are none other than the ringworm infections found in this country.

Ringworm infection was first discovered by Hebra, in 1860, as eczema marginatum. It was later discovered to be of mycotic origin by Kolobler, Pick, and Kaposi. In 1907, Sabouraud isolated and described the fungus epidermophyton inguinale. During the world war ringworm was found to be the most common skin disease. The U. S. Public Health service reported that one half of all adults have this disease at some time or another and that in the gulf states almost the entire population is affected. Nine tenths of the habitue's of gymnasiums have this disease. Most people attending gymnasiums or pools at golf clubs, fraternal organizations, public bath houses, military organizations, hotels, schools,- in fact anywhere the feet are exposed are found to have this ringworm infection. Ruggles of Rochester New York, taking 34 cases at random at Rochester Y. M. C. A. found everyone to be infected.

Ringworm of the feet is world wide and age old. At the University of California where there are students from all over the world, it was found that the majority of the entrants have the foot infection.

Eighty-five percent of the students taking athletics have it. The more the feet are liable to exposure the more have it. The infection is less prevalent in primary schools, more prevalent in high schools and most prevalent in the colleges. A survey of thirty five universities disclosed that between fifty and ninety percent of the students to be involved. All statistics show a definite variation in the proportion of males and females involved. Various colleges show from fifty to ninety percent of the boys affected and from fifteen to forty percent of the girls. Among the reasons mentioned why the girls are less affected is that their gymnasiums are better equipped. Boy's gymnasiums are more apt to have wooden floors, and their equipment is not so elaborate or quite as sanitary as the girls. The girls too never go barefoot, have less occasion to perspire, keep better personal hygiene and wear lighter, ventilated shoes which they change oftener.

Various types of moulds cause ringworm, the principle species of which is trichophyton interdigitale. As a matter of fact, in any form of ringworm of the feet the organisms are found not only about the toes but also usually about the nails, and it is frequently very difficult to subdivide the conditions.

There are several varieties of ringworm of the feet.; the carrier type in which there are no symptoms. There is the desquamating type, in which there may be a slight superficial peeling of the skin between the toes or about the nails. This is the commonest type. The desquamation may become heaped up and boggy, presenting the sodden variety. There is the vesicular type in which there are found small and large waterlike blisters. In the eczematous type there are inflammation and discharge. Cracking of the skin and fissure formation are common in any of the forms. Fluid and scabs are found in the vesicular and eczematous types.

It is rare to find pus but occasionally it may be found in the vesicles. The chief site of infection is found in the interdigital spaces, especially between the third and fourth toes and it frequently involves the nails. Itching, burning pains and other varieties of paresthesiae are the rule. From one to three percent of cases of ringworm of the feet are of the more severe type so as to be disabling. When nails are affected they become overgrown and may present longitudinal and transverse striae. There may be only the edge involved or it may cause separation of the nail from its base or bed. Thickening of the cuticle is also found. Infection of the nails is common, resists treatment and is apt to recur and persists after the skin condition has cleared up. The infection may last from several weeks to many years and there are cases on record where dermatologists cannot cure themselves. As with any infection there may be a secondary invader which distorts the picture depending upon the type of secondary infection.

As the disease is communicable the matter of prevention has been quite problematic and the ideal condition would be, not to expose the feet at any time to the infection. In as much as the infection seems to be universal the use of rubber, paper and even wooden slippers are used but when these are removed in showers to wash the feet, the technique is broken and feet are exposed. There should be no exchanging of towels, suits or soap or any clothing used in gymnasiums. The spread of infection is usually from the feet to other parts of the body, so it is advisable to use the towel on the feet last. It is advisable to boil towels, suits and hose to remove remaining organisms.

Reinfection is difficult to overcome. If the organism is destroyed on the footwear, floors or other members of the family may cause reinfection. Footwear should be light, well ventilated and changed preferably night and morning. Antiseptic powders should be applied between the toes and footwear.

Floors of swimming pools should be made of readily cleanable substances. There is no specific medication for this condition. Nearly every antiseptic has been tried at some time or another. Among the substances used are two percent acetic acid, 1; 1000 potassium permanganate, iodine, mercurochrome-220 soluble, camphor and iodine, Whitfield's ointment, Pick's ointment, pine and tar ointment, chrysarobin, zinc sulphate, two percent gentian violet, moderate carbo fuchsin and burnt elm. Various powders such as thymol iodide, have been placed in shoes. Floors have been rubbed with formaldehyde, nails have been scraped, X-rays have been applied to lesions. Some cases are relieved early by any of the above treatments and some have been subjected to them all with little or no relief. The multiplicity of types of treatment is a confession of the inadequate specific treatment of any type.

The Albany Junior High School routine examinations revealed hundreds of cases of ringworm with ninety seven percent a mild desquamating type, with three percent the sodden vesicular, eczematous type. There, students were not allowed to participate in gymnastics and were not allowed to enter the swimming pool. Swabbing with iodine and mercurochrome- 220 soluble was done in most cases and did not check the condition. Early in November of 1929, foot baths containing from ten to fifteen percent sodium thiosulphate were installed between the showers and locker rooms and each student was requested to immerse his foot in this chemical bath on the way to the locker. In so doing the solution was spattered over the locker room floor so that from the time the student left the shower until the time of dressing, the feet were constantly in contact with this thiosulphate solution.

The sulphite solution was effective as low as three percent so

that starting at ten to fifteen percent, plenty allowance is made for dripping into the bath, plain water. The bath was changed after each class of thirty to fifty pupils. The sulphite solution is ideal in being colorless and practically odorless. Four weeks after these baths were installed the ringworm infection had entirely disappeared from the Junior High School

Swabbing was usually done on the more apparent areas where tinea was plentiful as a constant source of reinfection. It is undoubtedly not so much the medicament applied as to the mode of application that causes its failure in the form of treatment. A twenty percent powder of sodium thiosulphate in boric acid has been tried with much success on the feet, footwear and floors, as it is easily applied in the sock and inside of the shoe and a light dusting is all that is necessary. This powder may be used as a prevention and gives foot comfort when the feet are sweaty.

Goodman (6) , taking up the clinical considerations of ringworm points out that treatment should be governed by the clinical picture presented in each case. The lesion is originally made up of vesicles which spreads clearing in the center. Sometimes the circlet begins anew within the cleared part giving concentric circles. Tincture of iodine is excellent treatment for ringworm of the non hairy skin. The iodine tincture must reach the skin so it is good treatment to remove the scales and crusts before each application. Also since the disease is an advancing one the antiseptic should be painted beyond the edge of the clinical lesion.

Ringworm of the toes is rightly the ringworm of opposing surfaces where is found warmth and moisture to afford good culture medium. There is no doubt that this type of clinical picture in the old days

has been called *scabies pedum*, *scabies*, *scabies*.

has been called eczema marginatum, tinea cruris, jock strap itch, dhobi itch, and washer womans itch. All of these conditions are thought to be responsible for nearly all the ringworm of the feet which was found to be pandemic. In ringworm of the toes the favorite location seems to be between the fourth and fifth toes, -there is slight scale and itching and that is about all. Then we have more advanced cases where all toe spaces are invaded. Its popularity in the last ten years has been blamed on infected soldiers of the world war but probably the community swimming pools, beaches, golf club locker rooms and other gathering places act to disseminate the offending organism. It is claimed that one half of the people of past adolescent age at school or college in the U. S. have the infection in some phase of another.

The mercury arc lamp in quartz as used in therapy is hooded in a special type of filter which permits the passage of some of the invisible ultra violet and prevents some of the passage of the white visible light. Under the influence of these invisible ultra violet rays, hairs infected with tinea gleam a golden yellow fluorescence. The skin covered with the organisms of tinea versicolor also shine yellow. Tinea of the nails are not apt to give this color as does the tinea of the hands and feet. In ringworm of the hands and feet the mercury arc lamp as an aid to diagnosis is useless. Microscopic diagnosis as brought out by several observers, is the rational method of diagnosis, along with clinical evidence of the infection.

Rational therapy of the ringworm infection depends upon the location of the invading organisms. If the hair or hair follicle is infected,

treatment depends upon epilation so that antiseptic remedies may reach the infected areas. On the non hairy skin, removal of the scales and the crusts is a prerequisite to treatment with antiseptics. The fungi in the nail ringworm are deep seated in the matrix and large removal of the nail is required preliminary to treatment of nail ringworm. In feet cases, the thickened epidermis must first be removed. X-rays are important to remove hair and restore skin to normal, but x-rays do not destroy the fungi. The irradiation from mercury vapor arc lamps has benefited many cases of ringworm when the rays reach the organisms. Ordinary every day treatment of ringworm after the preliminary removal of hair , crusts, keratotic epidermis, or nail requires iodine in one form or another according to Goodman (6). He states that other antiseptics may do, but iodine is a great help. In alcohol, it apparently penetrates enough to reach the offending fungi. In goose grease, iodine has been used many years.

On the whole, good pharmacy plus some physical agents properly applied do cure ringworm.

Paynter and White, (15) who stress the value of microscopic examinations, state that most cases are diagnosed upon clinical findings alone. Fungi should be found to confirm diagnosis particularly in border line cases. A common laboratory procedure is the use of potassium hydroxide as a digestant. The ten percent solution seems to work very nicely and in a series of cases taken at the department of dermatology at Northwestern University, results were as follows ;

A total of sixty five cases shows percentage of various forms of fungus recovered from scrapings taken repeatedly between the toes,--

Hyphae - - - - -	62%
Mosaic - - - - -	23%

Yeast - - - - - 12%

Negative - - - - - 3%

The hyphae are the thread like filaments, easily recognized. The mosaic forms follow intercellular clefts giving pavement effect. The exact role of yeast is uncertain but it seems to be an offender in certain dermatosis.

Wiedman, (26) in a discussion of "The Newer Ringworm." includes all types of ringworm, regional or otherwise by the term dermatophytosis. Perhaps it should also include bacterial (phyton) infections, but that is rather too large an order. "Epidermomycosis" and "Epidermophytosis", are synonymous with it. In a nutshell it embraces the superficial fungus diseases which develop in the interdigital and intertriginous positions or which are extensions secondary to foci in such positions, excluding deeper mycosis such as sporotrichosis and blastomycosis.

In general the treatment of ringworm other than that on the toes is satisfactory. Parasitic ointment in sluggish cases result in cure in a few weeks. Tar, chrysarobin, and ammoniated mercury, but particularly salicylic acid are effective. Whitfield's ointment has and deserves high reputation and consists essentially of salicylic acid three percent, benzoic acid, five percent and proper proportion of petrolatum.

Treatment of the toes is a different matter. A small percent of cases clear up promptly and permanently. The dorsum of the foot clears up quite easily but between the toes the infection remains obdurate. The acute condition on the back of the foot may be treated with phenol and lime water, saturated solution of boric acid or white wash. Small doses of x-ray may be used as adjuvants. When the case resolves into treatment interdigitally the best treatment in Wiedmans opinion is Whitfield's ointment prepared as follows;

Starch paste ----- 25%

Zinc Oxide -----25%

Petrolatum -----50%

This is used as the base instead of petrolatum in the original Whitfield's ointment along with the previously stated proportions of salicylic acid and benzoic acid. This type of base is less sticky and the grease does not diffuse on the stocking or bed clothing as readily.

This must be thoroughly removed with olive oil every evening and new applied to prevent accumulation of residue. If this fails a tincture of iodine may be cautiously applied beginning with one half strength and if no reaction is seen use later full strength. Chrysarobin, twenty grains to the ounce, may be tried. Frequently four or five various treatments are applied before the disease clears. Before treatment is started the patient must be warned that treatment may not be early effective and some cases are never cleared. A few obstinate cases are much more easily handled if taken into confidence before treatment.

In as much as the fungi do not stand high temperatures, baking the feet may kill the organism but does not guarantee against recurrences.

In general Wiedman points out that the patient must not be promised too much in regard to the treatment of the condition occurring between the toes; relief may be promised with reservations when there is a secondary infection or eczematoid extension to the dorsum of the foot. Salicylic acid still remains the main drug in the treatment of both the toe and other forms of dermatophytosis.

Shamberg and Kolmer(18), in their search for desirable treatment of this fungus infection began their investigation and classification of old medicaments. The most desirable method of determining affinities

is first to employ the compound in a test tube, against cultures of various organisms. This with animal inoculation with the parasite and a subsequent injection of the compound under investigation should give some evidence as to the power of the stated compound.

Two methods were carried out, one termed the fungastatic test and the other the fungicidal test. The former used cultures of fungi planted on mediums containing various strengths of medicaments to be tested; the results indicating the inhibitory or restraining power of the compounds. In the fungicidal tests, the strength of medicaments and the amounts used, necessary to kill cultures was determined.

Three types of tinea were used namely;

1. trichophyton rosaceum,
2. microsporon audouini,
3. achorion schoenleinii,

The conclusions derived from the use of twenty or more medicaments are as follows;

1. They found selective affinities of certain medicaments and dyes for molds as well as bacteria.
2. The use of the tests appear to be an aid in the isolation of molds and bacteria in pure culture.
3. Iodine transcends all other medicaments in restraining the growth of certain molds but in aqueous solution it is inferior to other certain drugs in killing them.
4. Sodium oxymercury orthonitrophenolate (mercurophen) is superior as a fungicide in the test tube, to mercuric chloride and to iodine, and for superior to other medicaments used.

5. Among the dyestuffs, brilliant green was the best restrainer of the growth, but crystal violet proved distinctly superior as a fungicide. All of the dyes however are inferior to the mercurial compounds.

Osborne and Hitchcock, (14) reported a method for prophylaxis of ringworm of the feet which has proven satisfactory as judged by fungicidal tests in the laboratory and from practical experience in the high schools of the city of Buffalo, N. Y. , and other public and industrial institutions. They used the same general plan used by Schamberg and Kolmer, (18) with the exception of a few minor changes.

Culture tubes were used instead of petri dishes because of lessened liability of contamination. Sabouraud's dextrose broth being substituted for Sabouraud's dextrose agar. This was shaken after exposure with a water solution of sodium hypochlorite. Fresh cultures of the fungi were removed from Sabouraud's dextrose slants with sterile distilled water and shaken with glass beads until a dense homogenous suspension was secured. 0.5 c. c. of the suspension was transferred to 10 c. c. of Sabouraud's dextrose broth. Sterile pipets were used for each step in the procedure. Controls of distilled water were used in place of sodium hypochlorite and run with each test. Culture tubes were incubated for forth-eight hours and left at room temperature for four weeks for final reading. The results were as follows; trichophyton interdigitale organisms were uniformly killed with 0.15 percent of sodium hypchlorite after fifteen seconds exposure. The same was true of monilia pruzi and trichophyton gypseum. Blastomycoides immitis required 0.4 percent of sodium hypochlorite before no growth

#12.

was secured after fifteen seconds exposure to the chemical. It is evident from this experimental work that a solution of 0.5 percent sodium hypochlorite should kill all the common fungi found in ringworm of the feet with exposure of fifteen seconds to these organisms in a watery suspension. Fresh moist deposits should be killed with 0.5 percent solution providing the organisms have not penetrated the deeper cells in the horny layer of the epidermis.

The T. A. Paterson laboratories supplied the Buffalo high schools with rubber pans and sodium hypochlorite solution for one year. The pans were two feet square made of heavy rubber and weighed sixty pounds. The pans were filled every morning and thrown away at night and placed where every student was compelled to pass and use them. Later in newer schools, wells were built in the floor (tile) which obviated the necessary purchase of rubber pans. This procedure was employed over a period of nine to twelve months. Physical directors of each school were advised as to the method of checking results. The result showed that there were no new cases reported the entire year except from pupils from surrounding towns. The use of sodium hypochlorite as a fungicide is advantageous in as much as it is cheap, easily prepared, does not stain or irritate under dilutions of two percent.

Osborne and Hitchcock(14), believe that the experimental work with sodium hypochlorite has given an effective method of prophylaxis of ringworm of the foot but an extended trial is necessary. The installation of permanent wells in the floor of showers and locker rooms seem to be an ideal arrangement.

Beckett of the U. S. Veterans hospital of Gulfport, Mississippi,(1) brings out the fact that most of treatments are based upon salicylic acid or Whitfield's ointment in various strengths. Chrysarobin a favorite in the medical profession of England is extensively used but this is later denied by another English practitioner. Tincture of iodine, aristol, salt water, silver nitrate, ammoniated mercury, starch and zinc oxide, petrolatum, phenol, potassium permanganate, and German soapvirides have their advocates for certain conditions or stages of treatment. Scraping toenails and removal of dead skin with pumice stone have their place.

Castellani's (34), treatment has been employed quite extensively in New Orleans and along the coast for two years. He uses two paints. First a saturated alcoholic solution of basic carbo fuchsin in combination with aqueous carbolic acid solution, boric acid and acetone. The second is the same except ten percent resorcinol is added. X-ray in light skin doses has contributed to a cure in many instances.

Insoles of absorbent paper, especially for the front of the shoe, if only the toes are involved are of value in absorbing perspiration. Socks and shoes should be changed frequently and exposure to the sun is of considerable value. Feet should be washed and the lather allowed on them ten minutes before going under the shower. Feet should be dried carefully and cotton placed between the toes. The tincture of iodine, mercurochrome or alcohol may be applied to acute points of infection. It is safer to undertreat than overtreat. Salicylic acid in alcohol or some form of ointment is frequently applied. Dyes which will stain clothing is to be avoided. Where toes are fissured, gauze passing over

them aided with an antiseptic dusting powder is of value. Cases which develop a secondary infection and cellulitis may require care in a hospital. Beckett states that a severe case of long standing has improved to a stage of clinical cure by wading for a few minutes twice a day in the mud and salt water of the Gulf of Mexico. When improvement under certain treatment remains stationary he changes to a new drug because of the immunity to the treatment seen in the organism and the return to the original treatment after a few days seems to produce favorable results.

"In the main" he states, "attention to the minute details of treatment is just as important as the agent used in treatment."

Treatment of ringworm of the toes cannot be standardized according to Goodman, (5). Each case must be studied and treated on the basis of clinical findings. The localized dermatitis must be first cleared before any attack must be made upon the fungus. Medication is usually directed to soften the keratin in all cases and remove thickened keratin in hyperkeratotic cases. Wet dressings, emersion in salt water, the solution of potassium permanganate, alum acetate or combinations of these have all been recommended but none has reached unanimity of acceptance.

Goodman quoting from Whitfield's book gives the following treatment; "The thick horny layer between the toes and the sole of the foot renders it almost impossible to get the parasiticide in contact with the fungus. Great care should be taken to trim away all flaps of fringed skin and to remove roofs of vesicles or pustules. Recent cases are more easily cured than the old established ones and generally yield to ten days

of treatment with chrysarobin ointment. In treatment of old cases the skin is trimmed and painted with this solution; chrysarobin 20 c.c. , and sulfuric ether and acetone of each to 100 c. c. This is allowed to dry and a pair of cotton socks is put on. In the evening the solution is washed off and the feet dressed with;

benzoic acid----- 5.'

salicylic acid --- 3.

soft parrafin ----- 8.

coconut oil -----30.'

This does not stain the bed clothes but softens the skin. Next morning this is washed off, the skin trimmed again, and paint reapplied after which a second pair of socks is put on while the first pair is being boiled. Goodman has the patients use the keratolytic salicylic acid ointment in the morning because the day's activity may help massage the feet.

Wise, (27) has pointed out that an occasional patient may do well with one type of remedy while another with an eruption identical with the first will not respond or will even become aggravated under the same treatment. "this" he says " explains the habit of shopping among the dermatologists. " He mentions a list of formulas and combinations which have been used by various dermatologists with varying success namely;

1. Tincture of iodine,
2. Oils of menthol, clove, cinnamon, and eucalyptus,
3. Solutions of potassium permanganate, silver nitrate, and picric acid, salicylic acid, benzoic acid, mercury and mercurochrome solutions resorcin, chrysarobin, pyrogallic acid, sulfur and

various preparations of tar.

4. Certain amyline dyes are also used.

Frequently a diluted Burrow's solution (which consists of alum, five parts, lead acetate twentyfive parts, dissolved in five hundred parts of water) works well before attacking with stronger solutions.

The first point of therapy to be considered should be the treatment of the eczema for we are dealing with various clinical phases of eczema caused by the parasitic fungus.

White and Greenfield, (24) divided the ringworm eruptions into these various types:

1. Macular,
2. Vesicular,
3. Macerated,
4. Hyperkeratotic,
5. Papular,
6. Nail infections.

The therapeutic attack should consider the type of eruption, location and the various social and economic conditions directly referable to the patient's status in different walks of life. In severe cases confinement in the home or the hospital is almost an essential factor in affecting a cure. The chief difficulty encountered in the cure of these eruptions lies largely in the fact that they are not subjected to a sufficiently sustained and prolonged therapeutic attack. Patients should be subjected to continuous rather than intermittent attacks. Wise and Wiedman, think that remissions are in reality reinfections. The nails are the chief offender in actual reinfections.

Wise in his personal experience with the remedies mentioned

is limited and best results are obtained with wet dressings of diluted liquor Burorii, alcoholic solutions of salicylic acid, and ointments of chrysarobin.

The wet dressing tends to allay itching and tension, relieves congestion, softens the skin and promotes an opening and evacuation of vesicles and bullae. Burrow's solution is diluted with ten parts of water and applied with a light gauze dressing; oiled silk or a rubber dam should not be used except in dry hyperkeratotic cases. Following the wet dressing the application of an alcoholic solution of salicylic acid with a small camel hair brush varying in strength from twenty to thirty percent. This solution painted on the affected area three times a day and repeated until the skin desquamates in large solid flakes is good therapeutic treatment. The next step is the application of chrysarobin ointment according to the following;

Oleum risini -----30 mms.

Chrysarobin -----20 to 30 grams

Salicylic acid -----20 to 30 grams

Soft soap

Anhydrous lanolin of each q. s. to the ounce.

If itching is severe, phenol up to two percent and menthol up to one half percent may be added. It is to be applied in the morning and left on only at night, to be removed in the morning with olive oil.

If the patient is confined to bed it may be applied in the morning and left on all day.

Whitfield's ointment is used with successes by many dermatologists. Wise finds that the modified Whitfield's ointment is of benefit in chronic eruptions and a cure in milder cases. The formula here used is;

2 percent thymol,
6 percent benzoic acid,
12 percent salicylic acid

this is incorporated in a base of equal parts of lanolin and vaseline. The percentage of any of the ingredients may be raised or lowered to fit the case under observation.

Recurrences may be prevented by the daily application of either a two percent solution of mercurochrome or half strength tincture of iodine. The patient is instructed to wear paper shoes which are burned immediately after use.

Glaze (4), uses a strong ointment of salicylic acid to produce rapid and complete exfoliation of the affected skin; and the formulas suggested by Ruggles. He first applies an ointment consisting of

zinc oxide -----6.
petrolati - -----8.
ung. picis liquidum ---12.
ung. aqua rosae -----10.

Misce and add, phenolis 95% ----1.

M and S. Apply twice a day as directed.

This is used until the acute eczematous stage has subsided, to be followed by a wash composed of;

Tincture of iodine----- 6.
Spiritus of Camphorata ----25.

Wise finds it difficult to evaluate roentgen ray treatment in dermatosis. They may accelerate a cure but at times have been known to aggravate the trouble. Roentgen rays should be administered with due caution and only mildest local remedies should be applied with radio therapy.

Taylor of Havana Cuba (22) in his review of the subject of ringworm points out that Pusey noted that results of treatment of the chronic conditions are not nearly so definite and prompt as those of the acute condition. Legge and associates report that after extensive investigation of the disease, Whitfields' ointment and its modifications in their experience has proven far from satisfactory. Stevenson and Kinglerly with Thiens have called attention to the prolonged resistance of the organism to heroic modes of treatment. Wiedman says that in his hands a large number of drugs used in local treatment have caused a severe dermatitis without proportionate benefit to the sufferer. Wise submitting a long list of agents and formulas which he has found most useful confesses that the majority of them at best are unsatisfactory.

Taylor reports that in his experience freezing the subjected areas with ethyl chloride spray has given favorable results. In cases where secondary invaders have complicated the picture the mode of attack was to apply a continuous wet dressing of four percent boric acid solution (aqueous). In many cases there were undoubtedly reinfections due to failure to discard or disinfect contaminated footwear. In his article he shows a series of twenty cases in which the freezing method has proven an immediate satisfactory cure. In severe cases he freezes the affected areas from three to twenty times. In some instances for fifteen

to twenty seconds. He uses this method to control the infection of the nails by completely freezing the nails two or three times. In each case shoes were either discarded or treated by ethyl chloride or twenty percent salicylic acid in fifty percent alcohol. Under ordinary circumstances one complete freezing is administered daily to all lesions. The area is blanched and maintained from thirty to sixty seconds and the blanched area should extend five tenths of a centimeter beyond the periphery of the lesion. In patients hypersensitive to cold shorter freezings over a longer period of time is necessary to affect a cure. In treating the nails freezing may be maintained for two minutes. When an inflammatory reaction is set up as a result of the cold, resembling chilblains, treatment should be suspended for a day or two. After the treatment the lesions should be covered with a layer of gauze and adhesive plaster with small plaquets of cotton placed between the toes. Loose skin should be carefully trimmed and from one to six applications of the spray may be required to subside the infection.

The contra indications for such treatment are;

1. Chronic eczematoid conditions due to long standing mycotic infection.
2. An acute pyogenic infection.

Both these may be treated before freezing as previously mentioned.

Taylor(21) states that the conspicuous desquamation of diseased areas is greater than that caused by salicylic acid and undoubtedly is an important factor in the control of the disease. Proper observation and precautions against reinfection is a corollary to this or any other form of treatment.

Pusey of Chicago(17) in his paper considering the treatment of tinea dermatitis of the extremities, pointed out that the treatment of acute outbreaks is primarily a riddance of the active symptoms which is best done by wet dressings. The solution used by him is as follows; eight percent of a solution of aluminum acetate, one ounce, and distilled water, up to the pint. These are applied as continuously as possible. Boric acid, four percent and potassium permanganate 1: 3000 to 1: 6000 may be also used. At the same time it is desirable to paint the toes with a stronger antiseptic such as metaphen 1: 500 ;two percent solution of potassium permanganate, or two percent mercurochrome, 220 soluble. Before this is done the bullae should be opened and dead skin removed. Patients are warned against soaking the feet in hot water . Cases of acute lymph angitis should be given complete rest to the affected part.

When the acute stage has subsided the areas become covered with a heavy epidermis which is usually pink and scaling. This may be softened by application of wet dressings of a 1:3000 solution of potassium permanganate which may be carried further by soaking the affected parts with the aluminum acetate solution for ten to fifteen minutes night and morning and then applications of Whitfield's ointment full strength several times a day.

In the early acute stages the better mode of attack is the use of a weak Whitfield's ointment and gradually increasing the strength as the eczematoid condition becomes better. The painting of the above should be done ~~twice~~ daily.

In the application of this ointment, care should be taken to remove all of the remaining ointment from the previous application.

After the acute stage has subsided the treatment should be the use of as strong parasiticides as can be used without producing irritation. Of these the tincture of iodine is as effective as any in this stage of the disease. Also at this time the use of roentgen rays may prove beneficial but so far rational indications for their use is not clear.

Stevenson, (20) brings out that the patient should have a careful explanation of his disease, that it is infectious and communicable to his inmates. He is told to avoid shower baths and use only boilable clothing next to his skin. Use paper towels and discard old shoes, gloves, and so forth and obtain new wearing apparel. Wear wooden sandals when in a public shower.

In the vesicular type the vesicles should be opened antiseptically and hot soaks of potassium permanganate 1: 1000 applied. In moist macerated areas crude coal tar ointment does well. In scaling, fissured, keratotic types, Whitfield's ointment with an increased amount of salicylic acid is used effectively. X-ray is of value in cases associated with hyperidrosis.

The caution added in regard to treatment is that many drugs including volatile oils and chrysarobin should be used with caution as they frequently give rise to a dermatitis worse than the original disease.

Smith, (19) in his experimentation with the longevity of the organism, placed some thin scales between two clean glass slides and kept them in a dry place for three months. At the end of this time the laboratory succeeded in growing both tinea and a yeast colony on

Sabouraud's medium. It is very likely the organisms live on detached scales for a much longer time. Therefore articles such as gloves, sox, bath mats, slippers, rugs, bathroom floors, broom handles, tools, automobile steering wheels and brake handles and other sources of contamination should receive attention. Some of these may be sterilized by formaldehyde vapour; others will have to be dependent upon soap and water; some which cannot be sterilized should be discarded and those articles which can be should be boiled.

Uruena (23) of Mexico City in his discussion of ringworm in Mexico believes that as far as treatment is concerned, the removal of the scales after prolonged emersion of the feet in hot water by the use of pumice stone is necessary. This is quite a difficult procedure for the patient so it would be preferable to have the physician himself remove the scales after maceration by wet applications.

In a patient with ringworm of the soles of several years duration a cure was affected by only one treatment. But this patient had been using a water proof treatment believing that he had eczema. The softened layers were removed by a curet and the skin beneath was a pink (rose colored) and normal in every respect. Then a one percent solution of iodized alcohol and Lassar's paste was applied.

Some patients cannot be cured because scales are never completely removed. In case of patients manifesting intolerance to the drugs applied locally, Uruena effects a state of desquamation by non specific protein therapy; an autobemotherapy, a non specific milk preparation and peptone administered before, which causes focal reaction to disappear or diminish.

Hudgins, (8) states that constant warning is heard not to cause irritation of the skin by the use of medication especially salicylic acid but on the other hand a higher percent of this drug is found to be more efficacious than the usual three percent. So with this warning in mind and the knowledge that acetic acid is sometimes beneficial Hudgins tried acetyly salicylic acid with excellent results.

Cannon, (2) stresses cleanliness which of course is important but seems paradoxical when we know that ringworm is contracted about shower baths and those who are bothered most are the atheletic type who are apt to bathe most frequently.

Whitfields' ointment seems to be a panacea for this infection but Legge, (10) concludes that it is definitely contraindicated in the acute vesicular and raw varieties. Other preparations mentioned are liquid iocamphen, tincture of iodine, three percent, chrysarobin and iodoform in tincture of benzoin compound, tincture of iodine with ten percent acetic acid, and gentian violet.

Hudgins, (8) who was one of the first to try the acetyl salicylic acid treatment states that acetyl salicylic acid can be used as a powder or in an ointment base. He uses three drams of the acid or even stronger to the ounce of lanolin. Its advantages are;

1. rapid antipuretic effect,
2. non-irritating,
3. effective as a dusting powder,
4. response usually prompt.

He states that it appears to have somewhat of an analgesic effect and is not only non-irritating but actually soothing. In moderate cases of ringworm

infection, response was noted in about two days with one or two applications a day. In more severe infections a somewhat longer time and treatment was required and it is advisable to continue treatment after apparent cure has been effected.

In prophylaxis a dusting powder does not cause irritation and has been found very effective in cases under observation.

Cannon, (2) emphasizes that one of the most important features in the treatment of ringworm is cleanliness; daily scrubbing with soap and water followed by free use of antiseptic remedies and germicides. Stockings should be changed each day and shoes at frequent intervals. A thorough cleaning and drying the parts, paint with liquid iocamphen, or three percent of the tincture of iodine, wiping off the excess drug with a dry piece of cotton and dust with a bland powder, is good treatment of the foot infection. Where a more drastic remedy is necessary it is advisable to apply;

Chrysarobin ----- ʒss

Chloroform ----- ʒi

Tr. benzoin comp. Q. S. ʒi

M. and S. Wipe off the excess and apply talcum powder.

The acute vesicular and bullous affections of the extremities are best treated by opening the vesicles and applying

Bichloride ----- gr. lll

Resorsin -----drams II

Salicylic acid -----drams II

75% Alcohol, Q. S. Ounces I

M&S . Apply twice daily.

White, (25) of Boston also admonishes that the patient must be warned that the disease is infectuous and contagious and is auto-inoculable and must be warned against contact with leather or wooden objects, woolen objects of dress, toilet and sport.

Local treatment has proven disappointingly inadequate. The English relied on Whitfield's ointment, the French relied on tincture of iodine, and chrysarobin, and the Americans have tried everything and all in all have largely failed. The duration of this disease up to thirty years seems to corroborate this pessimism. He suspects that many of the cures are affected more by internal chemical processes than by the use of external applications.

For cleansing purposes and for reducing the horny layer, the use of hot soaks, pumice stone soap, flash soap, and the grinding effects of hot dry sandy beaches seems effective. Vesicles should be opened antiseptically and to all types the application of ether, tincture of iodine, hot soaks in the solution of potassium permanganate, one percent boric acid solution, saturated solution of trinitrophenol ten percent., or copper sulphate, four tenths percent or painted them with a solution of

Oil of Cinnamon ----- 2.

Thymol ----- 5.

Alcohol, Q. S. A. D. 200.

or the following;

Ether ----- 2.

Balm of Peru ----- 4.

Collodion flexible ---- 32.

On moist areas or areas that are macerated crude tar in from six percent to one hundred percent strength has been employed.

Crude coal tar -----2.
Zinc oxide -----2.
Petrolatum -----32.

This is known as Black lotion.

On the macular, scaling or fissured or hyperkeratotic forms the following ointments have been used with good effect; Whitfield's ointments number one and number two;

Salicylic acid -----	2.	} (Number one)
Percipitated sulfur ----	2.	
Lard -----	32.	
Mercurous chloride -----	10.	} (number two)
Lard-----	32.	

At this juncture it seems that Whitfields ointment has so many modifications that it is hard to recognize it or any other as Whitfield's ointment.

Another formula recommended by White is as follows;

Red mercuric sulphide -----.1
Salicylic acid -----1.5
Benzoic acid -----2.
Percipitated sulfur -----3.
Lanolin
Petrolatum a a -----30.

On epidermophytids in the summer the following wash is of value;

Phenol ----- 2.
 Calamine ----- 6.
 Zinc oxide ----- 8.
 Lime water q. s. a. d. 250.

But in the winter this formula is best used,

Phenol ----- 2.
 Calamine -----6.
 Zinc oxide ----- 8.
 Glycerine -----8.
 Aqua dest. -----250.

A long list of varied compounds signifies only one thing,- a confession of therapeutic weakness, However this is not the whole truth for during the last few months attention has been turned to a two percent aqueous solution of mercurochrome 220 soluble, (dibromoxymercurifluorescein) in almost all forms of epidermophytosis so the appearance of a new patient or the reappearance of an old one is no longer dreaded.

White seems to think that the mentioned drug is the most effective ever used by him although it is not one hundred percent efficient.

In the use of the two percent soluble mercurochrome all customary rules and regulations as to hygiene and antisepsis must be strictly adhered to as with any other form of medication in epidermophytosis. The liquid applied by means of a sterile swab once a day at first and following that twice a day with no bandages allowed. The drug only has one irritating quality and that is of dessication and in this quality lies its value as the plants need moisture. Within a certain number of days small cracks and fissures are found and are to be

interpreted as a signal to cease application of the drug. When the fissures have healed as they will in a few days with the cessation of treatment, applications should be resumed, but only once a day.

As the pathological symptoms disappear the drug should be used less and less but the treatment should be continued with decreasing intervals for a month after the disappearance of the last vestiges of the disease. The drug is easily soluble in water and easily removed when desired. It is also adherent to the skin and does not stain surrounding objects unless the patient perspires. The ease of application is a strong contrast with the time consuming soaks of of premercurochrome medication.

Guy and Jacob, (29) discussed whether a case of ringworm of the hands and feet should be treated as a parasite before it is demonstrated microscopically, and conclude that the clinical diagnosis is necessary.

Dixon's (35) treatment of soap and water with Whitfields' ointment has given good results. In one case he cultivated from the leather insole of a patients shoe the same fungus that was grown from the lesion from the foot.

McGlasson and Lehman, (36) point out that roentgen therapy in most cases shorten the course of the disease by at least one half.

Butler, Houghton and Cooper, (37) published a careful article of the tinea infection of the hands and feet. In treatment they found that potassium permanganate is recommended using with it acid peroxide of hydrogen to remove the stain. A liniment of soap is highly recommended but the roentgen ray in the treatment is considered unnecessary.

Petges in an article in the Archives of Dermatology and Syphology, volume fifteen; reviewing the literature, advises against harsh treatment. He forbids at first washing the affected areas and uses a zinc lotion with zinc ointment. Occasionally the zinc ointment is employed with the following wash;

zinc sulphate ----- 15.

copper sulphate ----- 15.

distilled water ----- 300.

sig. one soup spoon of this solution to a glass of water applied locally followed by zinc ointment.

Glaze, (4) recommends the use of a strong salicylic acid paste to remove the thickened epidermis from the soles, of the following formula;

Salicylic acid ----- 60 - 70.

Starch powder ----- 15 - 30.

Petrolatum ----- 90.

This applied from thirty to fifty hours. After desquamation a soothing ointment is used and the patient instructed as follows; apply the paste one fourth inch thick from the heel to the tips of the toes; smear the dorsum of the feet with petrolatum or cold cream; apply an old sock drawing it over all; and then the patient is told to renew applications twice daily if necessary. If the patient is unable to carry out this treatment continuously he is instructed to apply it for successive nights and he is not to walk after putting it on. The author states that out of seventy-four patients only five refused to finish the treatment after beginning it but it is not so well borne on the hand infections.

If the inflammatory condition is subsiding at night he uses

Benzoated lard ----- 35.

Anhydrous wool fat ----- 15.

Chrysarobin ----- 0.5

Zinc oxide ointment during the day or the following powder;

Talc. powder ----- 100.

Benzoic acid powder ----- 2.

Salicylic acid powder --- 2.

In torpid cases like dry eczema he treats with;

Tincture of iodine ----- 5 to 15.

Alcohol, 95% to make ----- 50.

and in powders with the foregoing powder twice daily. Also in such cases

Whitfield's ointments are used or;

Coconut oil ----- 80.

Petrolatum ----- 20.

Benzoic acid ----- 5.

Salicylic acid ----- 3.

Another compound he uses quite extensively is the same percentages of benzoic and salicylic acids in a base of benzoated lard and anhydrous wool fat. After the condition has largely subsided he advises prolonged treatment of daily washing and powdering with the benzoic salicylic powder as well as an investigation of the general condition of the patient.

Gray of London takes issue with Dr. White on the statement that English physicians rely almost intirely on Whitfield's ointment. He

advises that this statement is not entirely accurate and for the sake of his colleagues he would like to deny it but at the same time he uses Whitfield's ointment a good deal but thinks that best results are obtained by a dry application using a three percent salicylic acid with talcum powder. At the same time he advises the patients to soak their feet night and morning and instructs them as to rubbing away the scales with gauze and frequently the patient comes in and the physician removes as much of the dead skin as possible. In the vesicular type of lesion he uses solutions of acriflavine in strength 1: 1000 and potassium permanganate 1: 4000 together with the roentgen ray.

Later Wiedman, (26) in a more recent article discussing the laboratory aspects of epidermophytosis comes to the conclusion that it has been already emphasized that underlying the successful treatment of ringworm of the toes, is the removal of as much epiderm as possible. Thus far chemicals and antiparasitic drugs have been successful only to a limited extent. The residue of failures appear to be large. This seems certainly referable in part to failure of the drug to penetrate sufficiently deep, but doubtless many cases are cured by Whitfield's ointment and otherwise; however the periodic exacerbations are the result of the original. It is impossible to settle the point with finality; however the fungicidal, or at least the fungistatic titer of salicylic acid, and particularly its extreme keratolytic capacity, make it inevitable that many cases must be cured and that the recurrences are referable to reinfection.

Roentgen ray has been lauded by a number of followers but Wiedman seems to think that they have not made clear whether the improvement

has been made in cases where heavy keratosis overlies the infected area or in cases of the eczematoid type.

Since roentgen rays do not have any fungisidal powers, as used at present and since indirect effects have not been claimed for them, these cannot be regarded as rational therapeutic ones.

There is a possibility that some species of bacteris are synergistic toward fungi and under these circumstances micro-organisms which are effective against synergists would also rank as rational therapeutic agents.

Wiedman's cultures were almost killed within ten minutes by exposure to forty-eight degrees centegrade; this temperature may be withstood with some discomfort by the average foot. Some species of the fungus were killed by a five minute exposure. At any rate, enough was brought out to encourage him to generalize that most of the species were killed at temperatures far below the thermal death points of bacteris, not to mention the saprophytic forms. He also states that experiments in rational therapeutics are not final and that it is not recommended that the profession undertake to cure ringworm by this method at present.

Good results have been obtained when the following rules are applied although treatment should closely follow the clinical picture the patient presents:

1. In the eczematous type of case use astringent soaks namely

Zinc sulphate -----Drams II

Powdered alum -----Drams VI

Sig. One dram to a quart of water and soak twenty minutes.

2. Where there are many vesicles and fissures, paint the fissures with ten percent silver nitrate and then soak the feet as in number one.
3. Where there are few vesicles with no eczematoid condition use boric acid powder on the feet during the day and Whitfield's solution in alcohol as a paint once a day.
4. Where the epidermis is sodden and macerated paint on a ten percent solution of salicylic acid in alcohol on the infected area.
5. In case of painful fissures, paint them with ten percent silver nitrate.

When the acute condition has subsided it is advisable to use salicylic acid, benzoic acid and alcohol as a paint until there is adequate desquamation then use a two percent mercurochrome in Young's solution. This may be interchanged with metaphen occasionally which prevents recurrences. After the condition is apparently cured it is advisable to use Whitfield paint once a week with the mercurochrome painted on once a day. After several weeks of this treatment the mercurochrome may be used about once a week as a preventive of recurrence.

When the condition of the feet becomes irritated either due to hot weather or irritation caused by intensive treatment the condition on the hands occasionally flares up and may be of considerable worry to the patient. This is best let alone and will clear up as the foot condition is relieved. When the patient demands some form of treatment the vesicles may be opened and hot soaks applied, or the hands may be washed in formalin, one dram to a quart of water.

The following case histories will give some idea as to the variability of response to treatment;

Miss H. W. came to the office with small pin head sized vesicles on the hands with some scaling, itching between the toes accompanied by a small amount of weeping. She started using astringent soaks on both hands and feet once a day and during the day she used talcum in both her shoes and stockings. Stockings were boiled every day and shoes changed at least once a day. In two days she returned with her foot condition much improved and her hands better and was told to continue the same treatment. In one week she was much improved and there was considerable desquamation of both the hands and feet. Then Whitfield's paint was applied twice a day for two days followed by the application once a week. After two weeks the condition was much improved and mercurochrome was painted on her feet every other day and told to return in one week. She was then instructed to use the Whitfield's paint one week and paint the mercurochrome on her feet for the next three weeks and return. When she returned she was entirely cured as far as the clinical picture was concerned. Then after nine months she returned with a return of the condition with less severity. Similar treatment was instituted with favorable results. This represents a probable reinfection rather than a recurrence.

Mr. W. E. complained of scaling between the toes especially in the fourth interdigital space of the left foot accompanied with considerable itching. This condition was noticed about one month ago and allowed to go on with no treatment until present time. Then he went to the laboratory, Boston,

to a dermatologist who used x-ray, phytosin, butynpicrate, and hot soaks with little result. There was a moderately active finger infection of the inter digital spaces with the skin above this very tender. On the toes there were found in the interdigital spaces dull red areas and many vesicles and small blebs. Some of the areas on the feet were light red surrounded by vesicles.

His treatment was started by using boric acid packs. In two days he showed some improvement but there was considerable weeping between the toes. Then olive oil was applied to the feet using zinc stearate between the toes. In three days he was better and was put back on the boric acid packs. In three days he returned showing a sensitivity to olive oil so petrol agar was substituted. In two days there were less vesicles but more moisture between the toes. Then petrolagar was applied over the entire foot. In six days talcum was applied to the entire foot. In two days he was better and zinc sulphate gr. V, alum gr.⁴ and amyl and zinc oxide of each ounces I, was applied every three hours. In five days he showed more weeping between the toes so he used soap and water on the feet painting the lesions with ten percent silver nitrate. In two days he used one percent mercurochrome in acetone and placed on a general diet. Zinc ionization was tried on the left foot with poor results so it was stopped. In one week the fissures were cauterized with twenty percent silver nitrate and he was discharged in one week apparently cured.

This represents one of the severe cases that demanded hospitalization and every type of treatment heard of to bring about results.

H. S. D., a man of fifty came into the office with severe itching and eruption on the toes of the left foot, severe itching and vesicles on the surface of the great toe. He had not noticed that it involved other areas until two weeks ago when it appeared on the opposite toe. He had applied tincture of iodine which produced severe burning, erythema and vesicles. He was seen by a roentgenologist who quieted it down with zinc ointment. Two days ago, x-ray was given in small doses and during the night very severe itching of all toes made the patient very uncomfortable.

The diagnosis read, "All toes show many deep fissures and vesicles with the skin on intertiguous surfaces of toes devitalized and very white". Deep fissures in the interdigital surfaces. Severe dermatitis due to iodine burn.

Zinc sulphate and powdered alum soaks were given twice a day. The next day he was improved and the entire surface of the toes were denuded. The next day he was better but there was some spread of the infection. The following day there was still some infection on the toes of the left foot but the general condition was much drier and better. The following day vesicles appeared on the hands and they were soaked in the same solution. The feet were still being soaked once a day. The vesicles on the hands disappeared and there was considerable peeling on both the hands and the feet. Treatment continued as before.

At this time he became symptom free and stayed away for twenty days but returned after dancing to excess the night before. He then showed a red irritation on the dorsum of the third, fourth and fifth

toes. He was then given the acid alcohol paint to apply twice daily for two days and then once a day for two days. At night he soaked his feet in lysol, two drams to the quart of water. In one week he returned, his condition was much improved, and was told to continue treatment as before. One week later he returned symptom free and was dismissed.

Mr. P. M. entered the office with an erythematous eruption on the thighs of one and one half years duration. Itching was severe and examination disclosed interdigital scaling and fissuring of the toes but very few vesicles. The thighs showed sharply defined erythematous margins extending to the scrotum and down the legs. A diagnosis was made of tinea dermatitis of the toes and thighs. A solution of one percent salicylic acid, two percent benzoic acid in seventy percent alcohol was applied on the thighs and legs. The next day the condition was much improved and attention was paid to the foot condition. Full strength Whitfield's ointment was applied in alcohol and the condition cleared up.

This case is one of the many that respond immediately to treatment but the danger of reinfection is to be seriously considered. A quick early cure tends to make the patient less cautious of exposure to the organism. The cases that are more severe and difficult to clear up are more cautious and less liable to become reinfected.

Summary.

In general the treatment of ringworm of the feet is adequate and successful in the great majority of cases. There are a large number of treatments that have been used with variable success. The disease must be treated as a clinical entity and the social status and the economic condition of the patient must be taken into consideration. Treatment varies with the geographical distribution of the disease but generally Whitfield's ointment or some modification of the same is still very popular with the profession. Mercurochrome has come into its own as a form of treatment and an adequate prophylaxis. Various types of dusting powders are an aid especially in the summer when the feet are most apt to become hot and perspire.

There is a small percent of cases that do not respond to any type of therapy and it is these that are a constant source of worry to the dermatologist.

Under treatment rather than overtreatment is a good rule to follow because the cases of dermatitis that follow too strenuous therapy are for the most part worse than the primary infection. Reactions to various medicaments must be carefully watched for and guarded against, at all times.

Successful treatment of the ringworm infection is a valuable asset to any practitioner in this day and age of swimming pools, golf club showers, and increasing participation of athletics of all types.

"BIBLIOGRAPHY"

- (1). Beckett, C. G. "Ringworm of Tinea Infection of the Toes". U. S. Vet. Bureau Med. Bull. Vol. 6: 793-798, Sept. 1930.
- (2). Cannon, A. B. "Diagnosis and Treatment of the Commoner Types of Ringworm", Med. Clinics of N. A. Vol. 9: 629- 652, Nov. 1925.
- (3). Elford, P. W. "Treatment of Ringworm", Brit. M. J. Vol. I: 867-868, June, 1920.
- (4). Glaze, C. E. "Modification for Harrisons Treatment for Ringworm of the Nails", J. A. M. A. Vol. 75: 743-744, Sept. 11, 1920.
- (5). Goodman, H. "Rational Treatment for Ringworm of the Feet", Med. J. and Record, Vol. 131: 261-262, Mar. 5, 1930.
- (6). Goodman, H. "Clinical Considerations of Ringworm of the Feet" , Am. Med., Vol. 37: 77-81 ,Feb. 1931.
- (7). Gould, W. L. "Ringworm of the Feet", J. A. M. A., Vol 96: 1300-1302, Apr. 18, 1931.
- (8). Hudgins, A. P. "Acetyl Salicylic Acid in the Treatment of Ringworm" West Va. M. J. , Vol. 24:Mar. 5, 1930.
- (9). Kingery, L. B. and Thienes, C. H. "Paronychia and Dermatitis; a Hitherto Undiscribed Condition Apparently Peculiar to Fruit Cannerns" Arch. Derm. and Syph. Vol. 11: 186, Feb. 1925.
- (10). Legge, R. L. , Bonar, L. and Templeton, H. J. , "Ringworm of the Feet: Preliminary Report", J. A. M. A. Vol. 92: 1507, May, 4, 1925.
- (11). Levin, C. J. and Silvers , J. M. "Isolation of Ringworm Fungi from Sweat", Arch. Derm and Syph. Vol 23:1094- 1099, June 1931.
- (12). Livesey, G. H. " Scabies and Ringworm", Brit. M. J. Vol. 1:351, 352, Feb. 28, 1931.
- (13). Ormsby, O. S. and Mitchell, J. H. "Ringworm of the Hands and Feet", J. A. M. A. Vol. 67: 711, Sept, 11th, 1926.

- (14). Osborne, E. D. and Hitchcock, B. "Prophylaxis of Ringworm of the Feet", J. A. M. A. Vol.97:No. 7. Aug. 1931.
- (15). Paynter, M. and White , C. I. "Ringworm of the Feet: Value of Microscopic Examinations" J. Lab. and Clin. Med. Vol. 16: 380- 381, Jan. 1931
- (16). Percival, O. J. "Use of Thallium Acetate in Treatment of Ringworm of the Scalp", Brit. M. J. Vol. 1:575-577.1931.
- (17). Pusey, W. A. "Treatment of Tinea Dermatitidis of the Extremities" J. A. M. A. Jan. 1928.
- (18). Shamberg, G. F., and Kolmer, J. A. "Studies in the Chemo@therepy, of Fungus Infections" Arch, Derm and Syph. Vol:6:746- 751, Dec. 1922.
- (19). Smith, L. M., "Ringworm of the Hands and the Feet: Recurrences" Southwest Med. J. Vol. 14: 101- 103, Mar. 1930.
- (20). Stevenson, J. "Ringworm of the Hands and Feet", Jour. Okla. Med. Assn., Vol. 22: 113, 1929.
- (21). Taylor, K. P. A. "Treatment of Ringworm Infection of the Feet with the Ethyl Chloride Spray", Southern Med. J. Vol. 23,: 1128- 1130, Dec. 1 930.
- (22). Taylor, K. P. A. "Note of Epidermycosis of the Feet; Eighteenth Annual Report " Med. Dept of U. S. Fruit Co., P- 153, 1929.
- (23). Uruena, Gonzalez, "Ringworm of the Soles in Mexico; Clinical Study" Arch of Derm and Syph., Vol. 21: 909, June, 1930.
- (24). White, C. J. "Fungus Diseases of the Skin", Arch.of Derm. and Syph. Vol. 15: 387, Apr. 1927.
- (25). White, C. J. " Ringworm of the Feet" J. Cutan. Dis. Vol. 37; 105 Aug. 1919.
- (26). Wiedman, F. D. "Laboratory Aspect of Epidermycosis", Arch. of Derm. and Syph. Vol. 15: 415, Apr, 1927.
- (26). Wiedman, F. J. " Dermatophytosis-- The Newer Ringworm". J. A. M. A. Vol. 90: 7., Feb. 11. 1928.

- (27.) Wise, F. "Therapy of Ringworm Infections of the Hands and Feet", N. Y. State Med. J. Vol. 29:1461- 1464, Dec. 1929.
- (28). Pollitzer, S. " Discussion of Williams Paper", Arch. Derm and Syph., Vol. 15, : 463, 1929.
- (29). Guy, W. H. and Jacob, F. M. "Differential Diagnosis of Parasitic Infections of Hands and Feet"., Penn. M. J. Vol. 26: 384. Mar. 1923.
- (30). Dixon, H. A. " Fungi in Diseases of the Skin", Canada M. A. J. Vol. 14: 1097, Nov, 1924.
- (31). McGlasson, I. L. and Lehman, C. F., "Epidermaphyton and Trichophyton Infections of the Skin", Texas State J. of Med, Vol. 21: 380, Mar. 1924.
- (32). Butler, C. S. Houghton, J. E. and Cooper, G. F. "Mycosis of the Hands and Feet," U. S. Nav. Bull. Vol. 21: 615, Nov. 1924.
- (33). Glaze, A. "Treatment of Epidermomycosis of Feet and Hands," South. M. J. Vol. 17:643, Sept, 1924.
- (34). Castellani, A. "Treatment of Fungus Infections of the Feet", Med. and Surg. Jour. Vol. 80: No. 12: 833- 835. June. 1928.
- (35). Dixon, H. A. "Fungi in Diseases of the Skin ", Canada M. A. J. Vol. 14: 1097, Nov. 1924.
- (36). McGlasson, I. L. and Lehman, C. F. "Epidermophyton and Trichophyton Infections of the Skin", Texas State J. Med. Vol. 21: 380, Mar. 1924.
- (37). Butler, C. S. Houghton, J. E., and Cooper, G. F. , "Mycosis of Hands and Feet", U. S. Naval M. Bull. Vol. 21: 615, Nov. 1924.