



REFERENCES

1. Rippon, J. W., Medical Mycology, The Pathogenic Fungi and the Pathogenic Actinomycetes, pp. 532-581. W. B. Saunders Company, Illinois, 3rd ed., 1988.
2. Holbrook, W. P., J. A. Sofaer, and J. C. Southam, "Experimental Oral Infection of Mice with a Pathogenic and a Non-pathogenic Strain of the Yeast *Candida albicans*," Arch Oral Biol, 28 (12), 1089 - 1091, 1983.
3. McCracken, A. W., and R. A. Cawson, Clinical and Oral Microbiology, pp. 558 - 564. McGraw-Hill Book, New York, 1st ed., 1983.
4. Nolte, W. A., Oral Microbiology with Basic Microbiology and Immunology, pp. 514 - 553. The C. V. Mosby Company, Missouri, 4th ed., 1982.
5. Tilton, R. C., and M. R. McGinnis, "Fungi and Actinomycetes," Clinical and Pathogenic Microbiology (Howard, B. J., ed.). pp 515-629. The C. V. Mosby Co., St. Louis, 1987.
6. Martin, M. V., and G. R. Wilkinson, "The Oral Yeast Flora of 10-year-old Schoolchildren," Sabouraudia, 21, 129 - 135, 1983.
7. Vandenbussche, M., and D. Swinne, "Yeasts Oral Carriage in Denture Wearers," Mykosen, 27(9), 431 - 435, 1984.

8. Bartels, H. A. and H. Blechman, "Survey of the Yeast Population in Saliva and an Evaluation of Some Procedures for Identification of *Candida albicans*," J Dent Res, 1386 - 1390, 1962.
9. Ahearn, D. G., "Medically Important Yeasts," Ann Rev Microbiol, 32, 59 - 68, 1978.
10. Prachyabrued, W., and N. Chearapongse, "Studies on Oral Carrier of *Candida* species in Healthy Population," J Dent Assoc Thai, 34 (1), 1 - 7, 1984.
11. Chaiprasert, A., V. Skulchan, S. Imwidthya, and P. Disthaprasop, "Oral-yeasts' Incidence of Normal People and Patient with Oral Carcinoma," Siriraj Hosp Gaz, 37, 429 - 433, 1985.
12. Walker, D. M., "Candidal Infection of the Oral Mucosa," Oral Mucosa in Health and Disease (Dolby, A. E., ed.), pp. 467-505. Blackwell Scientific Publications, London, 1975.
13. Bodey, G. P. (ed.), "Candidiasis: A Growing Concern," in symposium, Am J Med, 77 (4D), 1 - 44, 1984.
14. Winner, H. I., "The Transition from Commensalism to Parasitism," Br J Derm, 81, 62 - 68, 1969.

15. Seto, B. G., and P. Tsutsui, "Invasive *Candida albicans* Infections of the Oral Cavity in Immunocompromised Patients," J Oral Med, 41 (1), 9 - 13, 1986.
16. Schmitt, J. A., "Epidemiological Investigations of Oral *Candida albicans*," Mycopathologia et Mycologia applicata, 43 (1) 65 - 87, 1971.
17. Cawson, R. A., "Thrush in Adult Out-Patients," Dent Practit, 15 (10) 361 - 363, 1965.
18. Cawson, R. A., "Denture Sore Mouth and Angular Cheilitis," Brit Dent J, 115, 441 - 449, 1963.
19. Cawson, R. A., Essentials of Dental Surgery and Pathology, pp. 242 - 249, Churchill Livingstone (Longman Group Ltd.), Hong Kong, 4th ed., 1984.
20. Newton, A. V., "Denture Sore Mouth," Brit Dent J, 112, 357 - 360, 1962.
21. Budtz-Jorgensen, E., and U. Bertram, "Denture Stomatitis 1. The Etiology in Relation to Trauma and Infection," Acta Odontol Scand, 28, 71 - 92, 1970.
22. Niel, D. J., "Symposium on Denture Sore Mouth," Dent Practit, 16, 135 - 148, 1965.
23. Lehner, T. C., "Immunofluorescence Study of *Candida albicans* in Candidosis, Carriers and Controls," J Path Bact, 91, 97 - 104, 1966.

24. Jenkins, W. M. M., T. W. Macfarlane, M. M. Ferguson, and D. K. Mason, "Nutritional Deficiency in Oral Candidosis," Int J Oral Surg, 6, 204 - 210, 1977.
25. Jepsen, A., and J. E. Winther, "Mycotic Infection in Oral Leukoplakia," Acta Odont Scand, 23, 239 - 253, 1965.
26. Lilienthal, B., "Studies of Flora of the Mouth-III. Yeastlike Organism: Some Observations on Their Incidence in the Mouth," Aust J Exp Biol Med Sci, 28, 279 - 286, 1950.
27. Lehner, I. C., "Oral Candidosis," Dent Pract, 17, 209 - 216, 1967.
28. Budtz-Jorgensen, E., "The Significance of *Candida albicans* in Denture Stomatitis," Scand J Dent Res, 82, 151 - 190, 1974.
29. Sharon, A., I. Berdicevsky, H. Ben-Aryeh, and D. Gutman, "The Effect of Chlorhexidine Mouth Rinses on Oral *Candida* in a Group of Leukemic Patients," Oral Surg, 44, 201 - 205, 1977.
30. Davenport, J. C., "The Oral Distribution of *Candida* in Denture Stomatitis," Brit Dent J, 129, 151 - 156, 1970.
31. Budtz-Jorgensen. E., "Denture Stomatitis V *Candida* Agglutinins in Human Sera," Acta Odontol Scand, 30, 313 - 325, 1972.

32. Budtz-Jorgensen, E., "Clinical Aspects of *Candida* Infection in Denture Wearers," JADA, 96, 474 - 479, 1978.
33. Berdicevsky, I., H. Ben-Aryeh, D. Glick, and D. Gutman, "A Strip Test for Detecting *Candida* in the Oral Cavity," Oral Surg, 44, 206 - 209, 1977.
34. Arendorf, T. M., and D. M. Walker, "Oral Candidal Populations in Health and Disease," Brit Dent J, 147, 267 - 272, 1979.
35. Arendorf, T. M., and D. M. Walker, "The Prevalence and Intra-oral Distribution of *Candida albicans* in Man," Arch Oral Biol, 25, 1 - 10, 1980.
36. Youmans, G. P., "Cryptococcosis, Candidiasis, and Aspergillosis," The Biologic and Clinical Basis of Infectious Diseases (Youmans, G. P., Paterson, P. Y., and Sommers, H. M. eds.), pp. 401 - 416, W. B. Saunders Company., Philadelphia, 3rd ed., 1986.
37. Taschdjian, C. L., J. J. Burchall, and P. J. Kozinn, "Rapid Identification of *Candida albicans* by Filamentation on Serum and Serum Substitutes," Am J Dis Child, 99, 212, 1960.
38. Budtz-Jorgensen, E., and H. Loe, "Chlorhexidine as a Denture Disinfectant in the Treatment of Denture Stomatitis," Scand J Dent Res, 80, 457 - 463, 1972.

39. Scully, C., and D. K. Mason, "Therapeutic Measures in Oral Medicine," Oral Manifestations of Systemic Disease. (Jones and Mason eds.), pp. 530 - 542, W. B. Saunders Company Ltd., London, 1st ed., 1980.
40. Williamson, J. J., "Method of Counting *Candida albicans* in Saliva," J Dent Res, 47, 979, 1968.
41. McGinnis, M. R., Laboratory Handbook of Medical Mycology, Academic Press, New York, 337-410, 1980.
42. Beneke, E. S., Medical Mycology Manual, 4th ed., Burgess Publishing Company, Minnesota, 1980.
43. Kreger-van Rij, N. J. W., (ed.), The Yeasts, 3rd ed., Amsterdam: Elsevier Science Publishers B. V., 1984.
44. Sukroongreung, S., "A Glutinous Rice Culture Medium for Demonstration of Chlamydospore of *Candida albicans*," Mycopathologia et Mycologia applicata, 43 (3-4), 320 - 335, 1971.
45. Williamson, J. J., "A Study of the Extent of Variation in Daily Counts of *Candida albicans* in Saliva," Aust Dent J, 17, 106-109, 1972.
46. Itharatana, K., "Imprint Culture for Detection of *Candida* in the Oral Cavity," J Dent Assoc Thai, 8, 203 - 215, 1985.

47. Vigneswaran, N., O. P. Hornstein, W. Niedermeier, and M. Gruschwitz, "Immunohistochemical Study of Palatal Salivary Glands of Denture Wearing Patients," J Oral Pathol, 17, 230 - 235, 1988.
48. Sreebny, L. M., The Salivary System, pp. 95 - 134. CRC Press, Inc., Florida, 1st ed., 1987.
49. Budtz-Jorgensen, E., A. Stenderup, and M. Grabowski, "An Epidemiologic Study of Yeasts in Elderly Denture Wearers," Community Dent Oral Epidemiol, 3, 115 - 119, 1975.
50. Odds, F. C., and A. B. Abbott, "A Simple System for the Presumptive Identification of *Candida albicans* and Differentiation of Strains within the Species," Sabouraudia, 18, 301-317, 1980.
51. Odds, F. C., and A. B. Abbott, "Modification and Extension of Tests for Differentiation of *Candida* species and Strains," Sabouraudia, 21, 79 - 81, 1983.
52. McCreight, M. C., D. W. Warnock, and M. V. Martin, "Resistogram Typing of *Candida albicans* Isolates from Oral and Cutaneous Sites in Irradiated Patients," Sabouraudia, 23, 403 - 406, 1985.

53. Auger, P., C. Dumas, and J. Joly, "A Study of 666 Strains of *Candida albicans*: Correlation between Serotype and Susceptibility to 5-Fluorocytosine," J Inf Dis, 439, 590 - 594, 1979.
54. Auger, P., C. Dumas, and J. Joly, "Interactions of Serotypes A and B of *Candida albicans* in Mice," Sabouraudia, 21, 173 - 178, 1983.
55. Poulain, D., G. Tronchin, A. Vernes, R. Popeye, and J. Biguet, "Antigenic Variations of *Candida albicans* in vivo and in vitro - Relationships between P Antigens and Serotypes," Sabouraudia, 21, 99 - 112, 1983.
56. Suzuki, M., and Y. Fukazawa, "Immunochemical Characterization of *Candida albicans* Cell Wall Antigens: Specific Determinant of *Candida albicans*, Serotype A Mannan," Microbiol Immunol, 26, 387 - 402, 1982.
57. Reiss, E., D. G. Patterson, L. W. Yert, J. S. Holler, and B. K. Ibrahim, "Structural Analysis of Mannans from *Candida albicans*, Serotype A and B and from *Torulopsis glabrata* by Methylation Gas Chromatography Mass Spectrometry and exo- α -Mannanase," Biomed Mass Spectrom, 8, 252 - 255, 1981.

58. Martin, M. V., and D. J. Lamb, "Frequency of *Candida albicans* Serotypes in Patients with Denture-induced Stomatitis and in Normal Denture Wearers," J Clin Pathol, 35, 888 - 891, 1982.
59. Joynson, D. H. M., et al., "Defects of Cell-mediated Immunity in Patients with Iron-deficiency Anaemia," Lancet, 2, 1058, 1972.
60. Mitchell, A. B., et al. "Survival of *Candida* Septicemia Treated with Amphotericin B," Postgrad Med J, 48, 436, 1972.
61. Chen, T. Y., and J. H. Webster, "Oral Monilia Study on Patients with Head and Neck Cancer During Radiotherapy," Cancer, 34, 246, 1974.
62. Jenkins, W. H. M., H. C. Thomas, and D. K. Mason, "Oral Infection With *Candida albicans*," Scott Med J, 18, 192, 1973.
63. Fisher, B. M., P. J. Lamey, L. P. Samaranayake, T. W. MacFarlane, and B. M. Frier, "Carriage of *Candida* species in the Oral Cavity in Diabetic Patients: Relationship to Glycaemic Control," J Oral Pathol, 282 - 284, 1987.
64. Barrett, A. P., "Evaluation of Nystatin in Prevention and Elimination of Oropharyngeal *Candida* in Immunosuppressed Patients," Oral Surg, 58, 148 - 151, 1984.

65. Rodu, B., I. L. Griffin, and J. P. Gockerman, "Oral Candidiasis in Cancer Patients," South Med J, 77, 312 - 314, 1984.
66. McElroy, T. H., "Infection in the Patient Receiving Chemotherapy for Cancer: Oral Considerations," JADA, 109, 454 - 456, 1984.
67. Maksymiuk, A. W., S. Thongprasert, R. Hopfer, M. Luna, V. Fainstein, and G. P. Bodey, "Systemic Candidiasis in Cancer Patients," Am J Med, 77, 20 - 27, 1984.
68. Michelsen, P. A., L. R. McCarthy, and M. A. Propst, "Future Modifications of the Auxanographic Method for Identification of Yeasts," J Clin Microbiol, 5, 297 - 301, 1977.
69. Lane, G. A., E. C. Vinton, G. B. Adcock, and J. M. Hopkins, "Improved Auxanographic Method For Yeast Assimilation Comparison with Other Approaches," J Clin Microbiol, 2, 206-217, 1975.

APPENDIX

APPENDIX I

1. Yeast nitrogen base (YNB) agar.

Formula

Yeast nitrogen base (Difco)	0.67 gm
Noble's agar	20.00 gm
Bromcresol purple (0.1% solution)	20.00 ml
Distilled water	1000 ml

Preparation

1.1 Suspend YNB and Noble's agar in distilled water, heat to boiling with frequent agitation until the medium is completely dissolved and allow to cool at 60 °C, add bromcresol purple solution, and adjust pH to 7.2 + 0.5 by 0.1 N NaOH.

1.2 Dispense 15 ml in test tube and cotton plug.

1.3 Sterilize by autoclaving at 121 °C for 15 minutes.

1.4 Cool to room temperature before keeping in cold room (0 - 4 °C).

2. Carbohydrate discs

Formula

Carbohydrate	10.0 gm
(except for raffinose in 20.0 gm)	
Distilled water	100.0 ml

Preparation

2.1 Dissolve carbohydrate powder in distilled water and sterilize by filtration (0.45 micron, millipore membrane filter).

2.2 50 microliters of 10% carbohydrate solution was dropped on 8 mm sterile paper disc (Tokyo, Japan) by aseptic technique.

2.3 Allow the carbohydrate disc to dry at room temperature before keeping in cold room (0 - 4 °C).

3. Carbohydrate fermentation medium

Formula

Beef extract	3.0 gm
Peptone	10.0 gm
NaCl	5.0 gm
Distilled water	100.0 ml
Bromcresol purple (stock solution)	1.0 ml

Preparation

3.1 Suspend all ingredients in distilled water.

3.2 Adjust pH to 7.2 by 0.1 N NaOH.

3.3 Dispense 9 ml aliquotes in test tube with Durham tube.

3.4 Sterilize by autoclaving at 121 °C for 15 minutes.

4. Bromcresol purple (stock solution)

Bromcresol purple powder	1.6 ml
95% ethyl alcohol	100.0 ml

5. Stock carbohydrate solution

Sterilize 10% aqueous solutions of dextrose, maltose, sucrose, lactose, galactose, and trehalose by filtration. Add 1 ml of carbohydrate to one tube containing 9 ml of sterile fermentation broth.

6. Christensen's urea agar

Formula

Urea agar base	29 gm
Distilled water	1000 ml
Agar powder	17 gm

Preparation

6.1 Dissolve 29 gm of urea agar base in 100 ml distilled water and sterilize by filtration.

6.2 Melt agar powder in 900 ml distilled water, sterilize by autoclaving and cool to 50 °C.

6.3 Mix urea agar base and melted sterile agar thoroughly.

6.4 Aseptically dispense in sterile test tube and cool as slants.

7. Nitrate assimilation test medium

Formula

Yeast carbon base	11.7 gm
Noble agar	20.0 gm
Distilled water	1000.0 ml

Preparation

7.1 Mix all ingredients in distilled water and heat to boiling until the medium is completely dissolved.

7.2 Dispense 15.0 ml aliquote into 25 - 125 mm test tube and sterilize by autoclaving at 121 °C for 15 minutes.

7.3 Cool to room temperature and keep in cold room (0 - 4 °C).

8. Peptone disc

Formula

Peptone	1.0 gm
Distilled water	100.0 ml

Preparation

8.1 Dissolve peptone in distilled water and sterilize by autoclaving at 121 °C for 15 minutes.

8.2 Aseptically dispense 50 microliters of peptone solution on sterile disc (Tokyo, Japan).

8.3 Allow disc to dry at room temperature and keep in cold room.

9. Potassium nitrate disc

Formula

Potassium nitrate	1 gm
Distilled water	100 ml

Preparation : The same as peptone disc.

10. Sabouraud Dextrose Broth (Difco)

Formula

Neopeptone	10 gm
Bacto-dextrose	20 gm
Distilled water	1000 ml

Preparation

10.1 Suspend 30 gm of the powder Sabouraud Broth in 1000 ml distilled water.

10.2 Mix thoroughly until medium is completely dissolved.

10.3 Dispense 5 ml aliquotes in screw-capped tubes.

10.4 Sterilize by autoclaving at 121 °C for 15 minutes and keep in cold room.

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11. Carbohydrate solution

Ten per cent of 15 different kinds of carbohydrate aqueous solution except for raffinose (20%) were sterilized by filtration (0.45 micron, millipore membrane filter).

Combination of carbohydrate solution with yeast nitrogen base.

11.1 Add 50 ml sterilized carbohydrate solution to 450 ml sterilized yeast nitrogen base. Final concentration is 1% sugar.

11.2 Aseptically dispense 5 ml aliquotes in sterile test tube.

11.3 Keep in cold room (0.4 °C, warm to room temperature before use)

12. Glutinous rice agar for chlamydoconidia production

Formula

Glutinous rice powder	5.0 gm
Distilled water	1000.0 ml
Agar	10.0 gm
Tween	2.5 gm

Preparation

12.1 Dissolve glutinous rice powder in 100 ml distilled water and heat to boiling for 10 minutes.

12.2 Allow to cool and precipitate at room temperature for 2 hours and filtrate through cotton and gauze. The supernatant is collected about 500 ml solution.

12.3 Add agar to the solution and heat to boiling. Frequently agitate until it is completely dissolved.

12.4 Allow solution to cool to 50 °C, adjust pH to 7.1 - 7.2 with 0.1 N NaOH and add 2.5 ml of Tween 80.

12.5 Autoclave at 121 °C for 15 minutes and pour on plate.

13. Sabouraud Dextrose Agar (Difco)

Formula

Neopeptone	10 gm
Bacto-Dextrose	40 gm
Bacto-peptone	17 gm
Distilled water	1000 ml

Preparation

13.1 Suspend 65 gm of powdered Sabouraud Dextrose Agar in 1000 ml of distilled water and mix thoroughly.

13.2 Heat to boiling with frequent agitation until the medium is completely dissolved.

13.3 Dispense 5 ml in test tube and cotton pluge.

13.4 Sterilize by autoclaving at 121 °C for 15 minutes.

13.5 Cool to room temperature in a slant position and keep in cold room.

14. Sabouraud Dextrose Agar with antibiotics

Formula

Neopeptone	10 gm
Bacto-Dextrose	40 gm
Bacto-Peptone	17 gm
Distilled water	1000 ml
Sodium benzyl penicillin (Pagemex, Dumex)	1.5 mg/ml
Streptomycin sulfate (Streptomycin, Dumex)	5 mg/ml

Preparation

14.1 Suspend 52 gm of powdered Sabouraud Dextrose Agar in 800 ml of distilled water and mix thoroughly.

14.2 Heat to boiling with frequent agitation until the medium is completely dissolved.

14.3 Sterilize by autoclaving at 121 °C for 15 minutes.

14.4 Cool to 40 - 45 °C and mix with 1,000,000 units of sodium benzyl penicillin and 2 gm of Streptomycin sulfate, agitate until the antibiotics are completely dissolved.

14.5 Dispense 20 ml in sterile petri dish.

14.6 Cool to room temperature and keep in cold room.

15. McFarland nephelometer standards (68, 69)

	tube number							
	0.5	1	2	3	4	5	6	7
Barium chloride (ml)	0.05	0.1	0.2	0.3	0.4	0.5	0.6	0.7
Sulfuric acid (ml)	9.95	9.9	9.8	9.7	9.6	9.5	9.4	9.3
Approx. cell density ($\times 10^8$ cells/ml)	1	3	6	9	12	15	18	21

APPENDIX II

Table 18 Frequency of detection of Candida in 3 groups study

	GROUP 1	GROUP 2	GROUP 3
AP	21.05	59.26	95.00
PP	21.05	51.85	87.50
RB	25.00	51.85	80.00
LB	22.37	40.74	85.00
RC	25.00	51.85	67.50
LC	25.00	40.74	67.50
AT	31.58	62.69	97.50
PT	52.63	66.67	97.50
LA	19.74	33.33	55.00
FL	14.47	25.93	55.00
D	not done	59.26	95.00

Table 19 Mean density by site in 3 groups study

	GROUP 1	GROUP 2	GROUP 3
AP	0.39	0.85	2.40
PP	0.32	0.93	1.88
RB	0.49	0.85	1.48
LB	0.53	0.74	1.58
RC	0.36	0.78	1.08
LC	0.32	0.63	1.00
AT	0.58	1.19	2.70
PT	0.96	1.37	2.85
LA	0.38	0.48	0.80
FL	0.29	0.41	0.85
D	not done	1.78	3.55



BIOGRAPHY

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