A REVIEW ARTICLE ON: TURMERIC (CURCUMA LONGA)

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ABSTRACT-

Turmeric is also called as Curcuma longa, is used as a flavoring agent, medicinal herb, and dye in Asian countries. In India where Ayurveda is a system of herbal medicine, turmeric is known for strengthening and warming the whole body. The main component in turmeric is curcumin, which has a wide range of properties, such as anti-inflammatory, antioxidant, antimuta-genic, and antimicrobial. Experimental studies have shown the biological activities of the compound, but much more information on pharmacokinetics, bioavailability, and food content are needed. Whether the amount of curcumin in turmeric and curry powders is sufficient to suggest effects on biological activities and cancer risk is unknown. To determine and compare the quantitative amounts of curcumin that are present in several brands of turmeric and curry powders, a high performance liquid chromatography technique was used to analyze 28 spice products described as turmeric or curry powders and two negative controls. Pure turmeric powder had the highest curcumin concentration, averaging 3.14% by weight. The curry powder samples, with one exception, had relatively small amounts of curcumin present, and the variability in content was great. The curcumin content of these seasoning products that are consumed as a component of the diet should be considered in evaluating baseline tissue concentration and response to curcumin supplementation, which is under study in chemoprevention trials.

KEYWORDS- Introduction, Adulteration, MOA and Pharmacological action.

INTRODUCTION-

Turmeric is a flowering plant, Curcuma longa of the ginger family, Zingiberaceae, the roots of which are used in cooking.[1] The plant is a perennial, rhizomatous, herbaceous plant native to the Indian subcontinent and Southeast Asia, that requires temperatures between 20 and 30 °C (68 and 86 °F) and a considerable amount of annual rainfall to thrive. Plants are gathered each year for their rhizomes, some for propagation in the following season and some for consumption.The rhizomes are used fresh or boiled in water and dried, after which they are ground into a deep orange-yellow powder commonly used as a coloring and flavoring agent in many Asian cuisines, especially for curries, as well as for dyeing, characteristics imparted by the principal turmeric constituent, curcumin. Turmeric powder has a warm, bitter, black pepper–like flavor and earthy, mustard-like aroma. Curcumin, a bright yellow chemical produced by the turmeric plant, is approved as a food additive by the World Health Organization, European Parliament, and United States Food and Drug Administration.[2] Although long used in Ayurvedic medicine, where it is also known as haridra, there is no high-quality clinical evidence for using turmeric or curcumin to treat any disease.[3]

Synonnims of turmeric- Different names in different languages as Halda, Haldi, Hardee, Halad, Halede, Halada, Haldar, Aneshta, Bahula, Halud, Indian saffron, Turmeric, Lidar, Mannal, Halja, Manjal, Mancal.[4]

Taxonomical Classification-

Class- Liliopsida

Subclass- Commelinids

Order- Zingiberales

Family- Zingiberaceae

Genus- Curcuma

Species- Curcuma longa [5]

Figure- Turmeric rhizomes

Morphology-

Turmeric plants reach about 1 metre (3.3 feet) in height and bear long simple leaves with long petioles (leaf stems). The leaves emerge from the branching rhizomes that lie just below the soil surface. Older rhizomes are somewhat scaly and brown in colour, while young rhizomes are pale yellow to brown-orange.

Chemical Constituents-

Phytochemical investigations carried out on C. longa revealed the presence of many rich sources of polyphenolic curcuminoids, i.e., curcumin, demethoxycurcumin and bisdemethoxycurcumin.[10] Curcuminoids contain curcumin the principal curcuminoids (about 80%), and other two curcuminoids are demethoxycurcumin (about 12%) and bisdemethoxycurcumin[11,12] along with other one's protein (6.3%), fat (5.1%), minerals (3.5%), carbohydrates (69.4%), and moisture (13.1%). The essential oil (5.8%) obtainedby steam distillation of

rhizomes has a-phellandrene (1%), sabinene (0.6%), cineol (1%), borneol (0.5%), zingiberene (25%), and sesquiterpenes (53%).[6]

Medicinal Uses-

1.As part of the ancient Indian medical system, Ayurveda, a poultice of turmeric paste is used to treat common eye infections and to dress wounds, treat bites, burns, acne, and various skin diseases.[7]

2.In northern India, women are given a tonic of fresh turmeric paste with powder of dried ginger roots and honey in a glass of hot milk to drink twice daily after childbirth. Johnson and Johnson (An American Pharma Company) makes turmeric band-aids for the Indian market.[8]

3.A poultice of turmeric is also applied to the perineum to aid in the healing of any lacerations in the birth canal.[16]

4.Powdered turmeric when taken with boiled milk is helpful in curing cough and related respiratory ailment, and roasted turmeric is an ingredient used as an antidysenteric for children.[7]

5.Turmeric is also used in the treatment of dental diseases, digestive disorders such as dyspepsia and acidity, indigestion, flatulence, ulcers, antioxidant, antifertility as well to alleviate the hallucinatory effects of hashish, and other psychotropic drugs.[9]

6.In food and manufacturing, curcumin is currently used in perfumes and as a natural yellow-coloring agent, as well as an approved food additive to flavor various types of curries and mustards.[10]

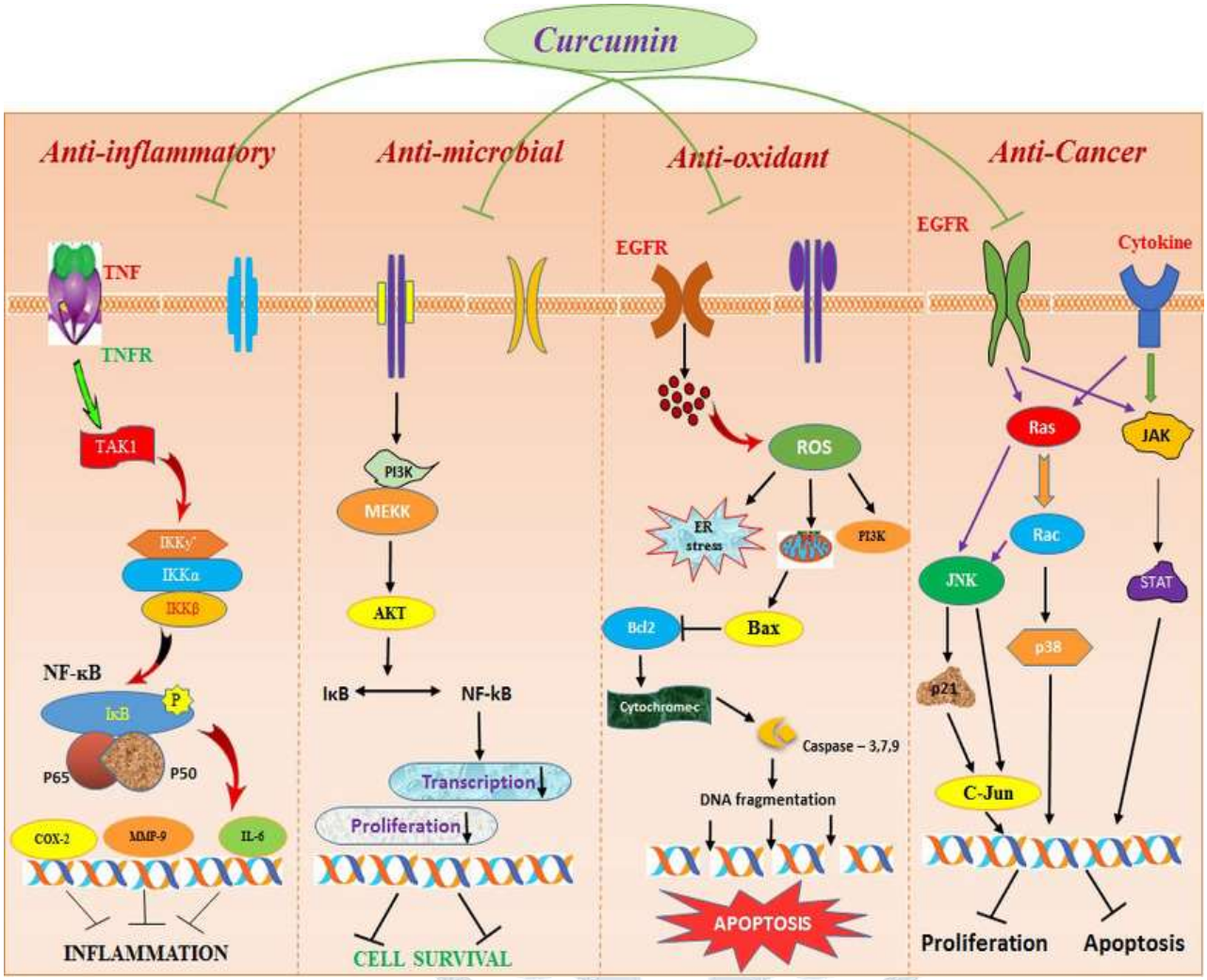
Note- Recent emphasis on the use of natural and complementary medicines in western medicine has drawn the notice of the scientific community to this ancient remedy. Current researches have revealed that curcumin has a surprisingly wide range of beneficial properties, including anti-inflammatory, antioxidant, and chemopreventive and chemotherapeutic activity. These activities have been demonstrated both in cultured cells and animal models and have paved the way

for ongoing human clinical trials.

ADULTERATION-

Turmeric and other spices are commonly the potential exist for powders of toxic, cheaper agents with a similar color to be added, such as lead (II, IV) oxide, giving turmeric an orangered color in its place of its native gold-yellow.Metanil yellow (also known as acid yellow 36) is another common adulterant in turmeric. It is believed to be an illegal dye for use in foods by the British Food Standards Agency.[11]

MECHANISM OF ACTION OF CURCUMIN-



PHARMACOLOGICAL ACTION OF CURCUMA LONGA :-

Action on gastrointestinal system-

Turmeric powder increases mucin secretion in rabbits and may thus act as gastroprotectant against irritants. It also shows both anti-ulcerand ulcerogenic activities. They also observed antiflatulent activity in both in vivo and in vitro experiments in rats. Curcumin was also found to increase intestinal lipase, sucrose, and maltase activity.Lin et al. have reported that curcumin suppresses intestinal fibrosis by inhibition of PPARΓ-mediated epithelial-mesenchymal transition. Zhang

et al.have carried out experiment on the protective effect of curcumin on TNBS-induced intestinal inflammation which is mediated through the JAK/STAT pathway and reported excellent results.[12]

Dyspepsia and Gastric Ulcer-

Curcumin has significant effect on dyspepsia and gastric ulcer. In a clinical trial phase II experiment, 45 subjects with endoscopically diagnosed peptic ulcers were given 600 mg curcumin 5 times daily for 12 weeks. It was seen that ulcers were absent in 12 patients (48%) after 4 weeks, 18 patients after 8 weeks, and 19 patients (76%) after 12 weeks. The remaining 20 patients, also given curcumin, had no noticeable ulcerations at the start of the study but were symptomatic-erosions, gastritis, and dyspepsia. Abdominal pain and other symptoms had decreased significantly within 1–2 weeks.[13] Kim et al. discovered the defensive effect of turmeric ethanolic extract against gastric ulcers by blocking H2 histamine receptors (H2R) of male Sprague–Dawley (pylorus-ligated) rats. The effect of C. longa extract was compared to the properties of ranitidine. Curcuma was found to protect the gastric mucosal layer as effective as ranitidine. Orally administered ethanolic extract is believed to inhibit gastric acid, gastric juice secretion, and ulcer formation comparable to the properties of ranitidine. Rafatullah et al. examined the antiulcer activity of an ethanolic extract of turmeric. Administration of turmeric extract led to a noteworthy decrease in ulcer index and acidity of stomach contents. Pre-treatment with the turmeric extract reduced the intensity of ulceration.[14]

Antidepressant Properties and Effect on Nervous System

The antidepressant effect of curcumin was explored in chronic mild stress (CMS) model. In assessment with normal rats, rats suffering from the CMS procedure have a considerable lower consumption of sucrose, increased interleukin (IL-6), tumor necrosis factor alpha (TNF-α) levels, CRF, and cortisol levels. Ethanolic extract of turmeric causes to increase the sucrose intake to normal control levels reduced the CMSinduced increase in serum IL-6 and TNF-α level and reduced the CRF levels in serum and medulla oblongata to lower than normal. It also lowered

the cortisol levels in serum to normal levels. Antidepressants properties of turmeric are mediated through inhibition of monoamine oxidize A. Ethanolic extract of C. longa causes to reverse the decrease in serotonin, noradrenaline, and dopamine concentrations as well as the increase in serotonin turnover, cortisol levels, and serum corticotrophin-releasing factor. Xu et al. examined the consequence of orally directed curcumin on behavior in a long-lasting stress model of depression in rats. The antidepressant imipramine was used as a control. Administration of curcumin exhibited similar properties as imipramine. These discoveries propose that the properties of chronic administration of curcumin on the conduct of chronic stressed rats may be connected to the controlling properties of the dysfunction of the hypothalamic-pituitaryadrenal axis, through a discerning increase in brain-derived neurotrophic factor in the frontal cortex and the hippocampus of the rats. A direct effect of curcumin in decreasing the amyloid pathology of Alzheimer's disease (AD) has been shown by an experimental model of AD.[15]

Antiinflammatory Activity-

C. longa plays very vital role in reducing inflammatory swelling. Oral administration of curcumin was found to be as effective as cortisone or phenylbutazone in acute inflammation. Anti-inflammatory properties of C. longamay be endorsed to its skill to restrain both biosynthesis of inflammatory prostaglandins from arachidonic acid and neutrophil function during inflammatory states. Curcuminoids also prevent LOX, COX, phospholipases, leukotriene's, prostaglandins, thromboxane, nitric oxide elastase, hyaluronidase, collagenase, monocyte chemoattractant protein-1, interferon-inducible protein, TNF, and IL-12. It also decreases prostaglandin formation and inhibits leukotriene biosynthesis through the lipoxygenase pathway.[16]

Antoxidant Effect-

Several works have been done in the past for antioxidant property of curcumin. It acts as a scavenger of oxygen free radicals. It can protect hemoglobin from oxidation. In vitro, curcumin can significantly reduce speed of the production of reactive oxygen species such as superoxide anions, hydrogen peroxide, and nitrite radical production. This is done by activated macrophages, which take part in a vital job in inflammation. Different extracts of turmeric such as water and fat soluble and its curcumin component exhibit strong antioxidant activity. Pre-treatment of curcumin causes and decreases ischemia-induced changes in the heart.[17]

Anticarcnogenic Effect - Induction of Apoptosis

Curcumin plays an important role as anti-carcinogenic agent. Apoptosis by induction plays a significant task in its anticarcinogenic effect. Actually, apoptosis was caused by this and block cell-cycle series, both of which are involved in reducing cancerous cell enlargement in rat aortic smooth muscle cells.Although curcumin may act differen on different cell lines. However, leukemia, breast, colon, hepatocellular, and ovarian carcinoma cells go away through apoptosis in the occurrence of curcumin, lung, prostate, kidney, cervix, and central nervous system malignancies and melanoma cells illustrate fight to cytotoxic effect of curcumin. Curcumin also decreases the production of rat thymocytes. These powerfully involve that cell growth and cell death contribute to a common lane. In vitro and in vivo studies clearly indicated that turmeric and curcumin are proficient of suppressing the activity of several common mutagens and carcinogens in a variety of cell.types.[18]

Antimicrobial Properties-

Composition and antimicrobial activity of the essential oil from leaves of C. longa L. kasur variety was investigated. The antimicrobial properties of leaves of C. longa

were tested by disc diffusion method against various human pathogens, including eight fungal and five bacterial strains. Essential oil showed maximum resistance against Fusarium miniformes MAY 3629 followed by Bacillus subtilis ATCC 6633, whereas it exhibited least resistance against Fusarium oxysporum ATCC 48122.[19]

Antimutagenic Activity-

Curcumin shows together pro- and anti-mutagenic effects. Curcumin is shown to decrease the numeral of abnormal cells in cyclophosphamide- induced chromosomal aberration in Wistar rats at 100 and 200 mg/kg body wt doses. Turmeric also prevents mutation in urethane (a powerful mutagen) models.[20]

Anticoagulant Activity-

Curcumin has found to possess anticoagulant activity. Its mechanism of action is to inhibit collagen and adrenalineinduced platelet aggregation in vitro as well as in vivo in rat thoracic aorta. Grag reported antifertility activity about 100% in rats when fed orally in petroleum ether and aqueous extracts of turmeric rhizomes. Again Garg et al. also reported that implantation is totally repressed by these extracts. Curcumin is also found to inhibit 5a-reductase, which changes testosterone to 5a-dihydrotestosterone, in that way inhibiting the enlargement of flank organs in hamster. Curcumin also inhibits human sperm motility, and it is a sign of possible for the progress of a novel intra-vaginal contraceptive.[21]

Antidiabetic Effect-

A number of experiments carried out in the past which showed the antidiabetic property of curcumin. A hexane extract (containing ar-turmerone), ethanolic extract (containing ar-turmerone, curcumin, demethoxycurcumin, and bisdemethoxycurcumin), and ethanolic extract from the residue of the hexane extraction (containing curcumin, demethoxycurcumin, and bisdemethoxycurcumin) were found to dose-dependently stimulate adipocyte differentiation. In this experiment, it was found that ethanolic extract of turmeric

containing both curcuminoids and sesquiterpenoids is more powerfully hypoglycemic than either curcuminoids or sesquiterpenoids.[22]

Antifungal Effect-

Due to wide traditional use of turmeric in food products, several studies have been done to study the turmeric and curcumin with the aspect of regulatory fungal related spoilage and fungal pathogens. Concentration of curcumin plays very important role in prevention of growth of fungus. Addition of turmeric powder in plant tissue culture at the 0.8 and 1.0g/L had considerable inhibitory activity against fungal infections.The methanol extract of turmeric showed antifungal activity against Cryptococcus neoformans and Candida albicans with minimum inhibitory concentration (MIC) values of 128 and 256 µg/mL, respectively. Hexane extract of C. longa at 1000 mg/L confirmed antifungal effect against Rhizoctonia solani,Phytophthora infestans, and Erysiphe graminis. The study also revealed that 1000 mg/L of ethyl acetate extract of C. longa shown inhibitory effect against R. solani, P. infestans, Puccinia recondita, and Botrytis cinerea. At the concentration of 500 mg/L, curcumin displayed antifungal activity against R. solani, P. recondita, and P. infestans. Curcumin and turmeric oil showed antifungal effect against two phytophagous fungi, namely, Fusarium solani and Helmintho sporium. Oil of turmeric showed the most effective antifungal activity against F. solani and H. oryzae with IC50 of 19.73 and 12.7 µg/mL, respectively.[23]

Antiviral Effect-

Curcumin also plays important role as an antiviral agent. It acts as an inhibition of Epstein–Barr virus key activator BamH fragment z left frame 1 protein transcription in RajiDRLUC cells. It also restrains UV light-induced HIV gene expression. Plants as a rich source of phytochemicals with different biological activities including antiviral activities are in interest of scientists. Due to the absence of successful

therapeutics for the most of viral diseases, rise of antiviral drug resistance and high cost of some antiviral therapies require finding new effective antiviral compounds.[24]

CONCLUSION-

The present review attempts to summarize the phytochemical, pharmacological, and molecular work done on turmeric. Turmeric and many of its chemical constituents were shown to have useful pharmacological actions to treat various types of disease. Curcumin is one such phytoconstituent and nutraceutical substance with numerous pharmacological activities verified experimentally and clinically. It has been recognized advantageous in treating anti-inflammatory, anti-allergic, antioxidant, antihyperglycemic, and anticancer properties.

5. REFERENCES-

1.Priyadarsini, KI (2014). "The chemistry of curcumin: from extraction to therapeutic agent". Molecules. 19 (12): 20091–112.

2.PubChem, US National Library of Medicine. 21 November 2020. Retrieved 25 November 2020.

3.National Center for Complementary and Integrative 0Health, US National Institutes of Health. May 2020. Retrieved 25 November 2020.

4.Chakraborty P.S., Ali. A. S., Kaushik Subhash, Ray K.R., Yadav P.R., Rai K.M. Curcuma longa - A multicentric clinical verification study. Indian Journal of Research in Homoeopathy, Vol.5, No.1, January-March 2011.

5.Nayak.V. Seema, Raut.N. Prachi. Mandhare .N.P. and Gotmare. R.S. Turmeric: The Golden and Precious Gift of Nature. Int. J. Adv. Res.

6.Vavilova NI. Turmeric a new spice and medicinal plant. Skogo Inst Rastenievodstva Im 1990;4:77-9.

7. Thakur R, Puri HS, Husain A. Major Medicinal Plants of India. Lucknow: Central Institute of Medicinal and Aromatic Plants; 1989.

8. MacGregor H. Out of the spice box, into the lab: Turmeric, an Indian staple, has long had medicinal uses. Now the West is Taking Notice. Los Angeles, CA: Los Angeles Times; 2006.

9. Pandeya N. Old wives tales: Modern miracles turmeric as traditional medicine in India. Trees Life J 2005;1:3.

10.Garg SK. Effect of Curcuma longa (rhizomes) on fertility in experimental animals.Planta Med 1974;26:225-7.

11. Food Standards Agency. Producing and Distributing Food-Guidance: Chemicals in Food: Safety Controls; Sudan Dyes and Industrial Dyes Not Permitted in Food, Food Standards Agency, UK Government. Available from: http://www.gov.uk. [Last accessed on 2012 Oct 08; Last retrieved on 2015 Dec 12.

12.Zhang X, Wu J, Ye B, Wang Q, Xie X, Shen H. Protective effect of curcumin on TNBS-induced intestinal inflammation is mediated through the JAK/STAT pathway. BMC Complement Altern Med 2016;16:299

13.Prucksunand C, Indrasukhsri B, Leethochawalit M, Hungspreugs K. Phase II clinical trial on effect of the long turmeric (Curcuma longa Linn) on healing of peptic ulcer. Southeast Asian J Trop Med Public Health 2001;32:208-15.

14.Kim DC, Kim SH, Choi BH, Baek NI, Kim D, Kim MJ,et al. Curcuma longa extract protects against gastric ulcers by blocking H2 histamine receptors. Biol Pharm Bull 2005;28:2220-4

15. Ringman JM, Frautschy SA, Cole GM, Masterman DL, Cummings JL. A potential role of the curry spice curcumin in Alzheimer's disease. Curr Alzheimer Res 2005;2:131-6

16.. Bundy R, Walker AF, Middleton RW, Booth J. Turmeric extract may improve irritable bowel syndrome symptomology in otherwise healthy adults: A pilot study.J Altern Complement Med 2004;10:1015-8.

17. Motterlini R, Foresti R, Bassi R, Green CJ. Curcumin, an antioxidant and anti-inflammatory agent, induces heme oxygenase-1 and protects endothelial cells against oxidative stress. Free Radic Biol Med 2000;28:1303-12.

18..Boone CW, Steele VE, Kelloff GJ. Screening for chemopreventive (anti-carcinogenic) compounds in rodents. Mutat Res 1992;267:251-5.

19.Parveen Z, Nawaz S, Siddique S, Shahzad K. Composition and antimicrobial activity of the essential oil from leaves of Curcuma longa L. Kasur variety. Indian J Pharm Sci 2013;75:117-22.

20.Hamss R, Analla M, Campos-Sanchez J, Alonso-Moraga A, Muñoz-Serrano A, Idaomar M. A dose dependent antigenotoxic effect of turmeric. Mutat Res 1999;446:135-9

21.Rithaporn T, Monga M, Rajasekaran M. Curcumin: A potential vaginal contraceptive. Contraception 2003;68:219-23.

22.Nishiyama T, Mae T, Kishida H, Tsukagawa M, Mimaki Y, Kuroda M, et al. Curcuminoids and sesquiterpenoids in turmeric (Curcuma longa L.) suppress an increase in blood glucose level in Type 2 diabetic KK-Ay mice. J Agric Food Chem2005;53:959-63.

23.Prucksunand C, Indrasukhsri B, Leethochawalit M, Hungspreugs K. Phase II clinical trial on effect of the long turmeric (Curcuma longa Linn) on healing of peptic ulcer.

24.Lemoine M, Nayagam S, Thursz M. Viral hepatitis in resource-limited countries and access to antiviral therapies: Current and future challenges. Future Virol 2013;8:371-80Southeast Asian J Trop Med Public Health 2001;32:208-15.