Evaluation of nanogold particles-based enzyme-linked immunosorbent assay for detection of hydatidosis
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Background
Use of nanotechnology in clinical diagnosis meets the demands for increased sensitivity and early detection in less time.

Purpose
The aim of this study was to evaluate the nanogold particles-based dot-enzyme-linked immunosorbent assay (ELISA) as a test for detection of protoscolices antigen in serum samples of infected animals in comparison with traditional dot-ELISA.

Methods
A total of 76 blood samples were collected and included in the study: 36 sample of hydatidosis confirmed cases, 20 samples infected with other parasitic infection except hydatidosis as positive controls, and 20 samples as negative controls. Dot-ELISA was applied using two polyclonal antibodies against protoscolices antigen, the purified immunoglobulin G (IgG) polyclonal antibodies, and peroxidase-conjugated IgG, whereas in the nanogold dot-ELISA, the purified IgG polyclonal antibodies were conjugated with nanogold particles.

Results
On detection of protoscolices antigen by dot-ELISA, 31 (86.1%) of 36 serum samples were found to be positive, whereas nanogold dot-ELISA gave 34 (94.4%) positive serum samples. Dot-ELISA with nanogold particles had higher values than dot-ELISA regarding sensitivity (94.4 vs. 86.1%), positive predictive value (94.4 vs. 93.9%), negative predictive value (78.3 vs. 90%), and accuracy (92.9 vs. 87.5%), but specificity (90%) was the same for both tests.

Conclusion
Nanoparticles-based dot-ELISA is superior over traditional dot-ELISA for the detection of protoscolices antigen in hydatidosis. Dot-ELISA is rapid and easy to perform and the results can be read with the naked eye, so it does not require expensive equipment.

Keywords: enzyme-linked immunosorbent assay, hydatidosis, nanogold

Introduction
Hydatidosis or cystic echinococcosis is a zoonotic parasitic disease, caused by infection with larval stage of *Echinococcus granulosus*. Although the disease occurs worldwide, it is endemic in Africa, South America, Europe, and Asia [1]. Mortality from hydatidosis is usually owing to the development of complications and is reported to be 2–4% [2]. The disease course is typically slow, and the diagnosis is often incidental owing to nonspecific symptoms [3]. Diagnosis is achieved by a combination of serologic tests and imaging, usually in conjunction with a history of exposure or immigration from an endemic area [4]. Many immunological assays have been developed for detection of antihydatid cyst antibodies and also for detection of hydatid antigens in the serum [5]. These include indirect hemagglutination, indirect immunoelectrophoresis, and enzyme-linked immunosorbent assay (ELISA) [6]. One of the main problems of antibody detection is that ~40% of the surgically confirmed patients fail to show antibodies by various techniques [7]. Moreover, the antibodies may persist for a long time, even after removal of hydatid cyst by surgery or after clinical cure by chemotherapy [8]. So, the antibody detection assay cannot discriminate between the past and present infections in hydatidosis [5].

The circulating hydatid antigen is present in the active or recent infection and is absent in patients treated with surgery or chemotherapy. Therefore, demonstration of the circulating antigen in the serum may indicate recent and active infection and may help in monitoring the...