Infection of the gastrointestinal tract (GIT) with helminths includes the three main groups: nematodes, cestodes and trematodes. They are detected by using conventional methods either by direct smear method or floatation/sedimentation technique which are laborious, time consuming and exhibited low sensitivity. Currently, recent progress in new diagnostic tools has opened new avenues in helminths detection. The immunological techniques which include enzyme linked immunosorbent assay (ELISA) and its modifications were appropriate for such diagnosis. They showed high sensitivity and specificity for such diagnosis. In addition, progress in molecular technique provide the potential for more reliable and efficient methods for diagnosis of helminth infection. Molecular methods such as PCR (the polymerase chain reaction), RLB (reverse line blotting), RT-PCR (real time-PCR), LAMP (loop-mediated isothermal amplification), and RFLP (restriction fragment length polymorphism) can be used as specific and sensitive tools for accurate detection of parasites DNA. PCR-based methods can be joined with RFLP or nested PCR for parasites genotypic. These combined methods can give different technique for the specific pathogen detection in stool. As well as, detection of low number of helminth parasites in stool samples by PCR is considered useful due to the higher detection sensitivity of PCR comparing to light microscopy. Recently, LAMP technique is helpful in detection of many parasitic agents and it is considered a golden tool for detection of helminths. Also, RLB method is a suitable diagnostic tool to define the characters of species in mixed infection.

Keywords: Diagnosis; helminths; livestock; ELIZA; PCR.
hematophagous nature causes degeneration of epithelial cells of GI tract and damage in mucosa which has been responsible for greater mortality of animals [6]. Also, some helminthes like Fasciola spp. have been known to cause organ damage due to either inflammatory reactions or mechanical effect. This will lead to severe morbid and reduction in productive and reproductive performances.

In Egypt, the prevalence of GIT parasites in 240 sheep was conducted from the zoo garden and Sinai district. The overall prevalence of infections in Sinai and zoo garden were 27.5%; 10.0% and 6.7% with nematodes; Fasciola spp. and coccidiosis respectively [7]. In addition Sultan et al. [8] investigated the prevalence, and public health importance of the GI parasites of sheep from Nile-Delta. The prevalence of GI parasites in a total of 224 individual sheep was 50%; Protozoa (29.02%) and helminths (37.05%). The prevalence of helminths infection was by Strongyle group (19.21%), Paramphistomes (9.38%), Strongyloides papillosus (4.02%), Trichuris spp. (2.68%), Moniezia spp. (0.89%) and Nematodirus spp. (0.45%).

For a long time, microscope has been considered the only tool available for the detection of helminths through tissue samples and feces. However, sample making ready for direct observation is labor keen, time-consuming, and depends on qualified laboratory technicians. Indeed, all major intestinal helminths infection are still entirely contingent on microscope for diagnosis [9]. Many parasite infections are confirmed by the use of other methods of diagnosis including serology-based assays and molecular-based assays in conjunction to microscopy [10]. Most of GI helminths are transmitted orally, but they differ in their definitive and intermediate hosts. They are detected by using conventional methods either by direct smear method and floatation/sedimentation technique which are laborious, time consuming and exhibited low sensitivity [11]. In addition, some nematode eggs did not float in NaCl [12].Currently, recent progress in diagnostic tools have achieved new avenues for improvement in helminths diagnosis. The immunological techniques which include ELISA and its modifications were appropriate for such diagnosis. ELISA have previously been reported for diagnosis of H. contortus [13] and T. circumcincta [14] in sheep and Ostertagia ostertagi in cattle, [15] it showed 99% sensitivity of diagnosis for such infections. Also, latex agglutination assay showed 100% sensitivity by using H. contortus crude antigen for diagnosis of sheep haemonchosis [16]. In addition, indirect ELISA and Western blotting (WB) in the diagnosis of sheep haemonchosis were applied by Sultan et al. [17]. However, infection of cattle with tapeworm, T. saginata, or Cysticercus bovis, also known as bovine cysticercosis, occurs worldwide [18]. Ogunremi and Benjamin [19] applied new trial for identification of T. saginata metacestodes in bovine lesions by using immune-histochemical stain complex. The most important GI trematodes that have zoonotic importance are F. gigantica and F. hepatica. They infect human and wide range of livestock as cattle, buffaloes and sheep and cause fasciolosis. Indirect ELISA proved 92% and 94.4% specificity and sensitivity, respectively in the diagnosis of cattle and sheep fasciolosis [20, 21]. In the last decade, several molecular tests have been developed to detect parasites in which their specificity and sensitivity have gradually been increased. Molecular methods such as the polymerase chain reaction (PCR), reverse line blotting (RLB), real time-PCR (RT-PCR), loop-mediated isothermal amplification (LAMP), and restriction fragment length polymorphism (RFLP) can be used as specific tools and sensitive for parasites DNA detection of [22, 23]. PCR-based techniques have a great role in the revolution and development of many areas of researches because only small amounts of material can be used for in vitro enzymatic amplification of DNA. This point is specifically important to parasitologist as it is commonly not possible to isolate large amount of parasite materials at their life cycle stages for typical analysis [24]. The cyathostomins helminthes (small strongyle) are considered the most important and common GI helminths infecting horses in livestock [25]. The eggs of cyathostomins origin were determined by larval cultures. The differentiation of cyathostomins group to species or genus level doesn’t determined by these culture. So molecular techniques have been applied for detection cyathostomins in faecal samples. These include PCR-ELISA and RLB assays [26, 27]. Furthermore, Learmount et al. [28] tested the validation of a RT-PCR method for diagnosis of T. circumcincta and H. contortus in sheep. LAMP technique is helpful in detection of many parasitic agents such as Taenia, Schistosoma and Fasciola spp [29, 30]. LAMP method is more sensitive than PCR in differential recognition of Taenia in stool samples. So, it is a golden tool for

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In addition, there are many studies that have been concerned with markers (mitochondrial DNA autosomal markers), such as microsatellites. These microsatellites have been applied only to a nematode species, like Trichostrongyloid [31]. The goal of this review is to highlight for the recent diagnostic technologies in GI helminths that affecting farm animals.

**Immunological diagnostic techniques**

The immunologist researcher efforts are directed to develop easy, fast, and less expensive methods in addition to high specific antigens and antibodies that can be used in immunological techniques. These can be useful in serology that in situations where samples are unavailable. The diagnosis which based on the serological tools can be divided into two categories: detection of antibody assays and detection of antigen assays. The serological tools include ELISA assay and other modifications assays like the Western blotting (WB), direct or indirect immunofluorescent antibody hemagglutination, rapid diagnostic tests, and complement fixation test [10]. ELISA is considered the suitable for evaluation of antibody titer and can also be successfully employed for the quantitative assessment of an antigen in a sample, often devised in convenient easy to use kit formats.

ELISA have previously been reported for diagnosis of *H. contortus* [13] and *T. circumcincta* [14] in sheep and *Ostertagia ostertagi* in cattle, [15] it showed 99% sensitivity of diagnosis for such infections. Moreover, it allows seroepidemiological studies and detection of infection in massive breeding of livestock [32, 33]. Cyathostomins (small strongyles) are considered the most important GI helminths in horses worldwide. These include *Anoplocephala perfoliata*, *S. vulgaris*, and *Parasarcis equorum*. All have been related with weight loss, poor growth, and clinical symptoms [34-36]. Dowdall et al. [37] showed that a protein named cyathostomin gut-associated larval antigen-1 have shown a promising diagnostic potential for detection of encysted small strongyles. This protein was only expressed in the larval stages and specific for cyathostomin species.

Indirect ELISA and WB in the diagnosis of sheep haemonchosis were applied by Sultan et al. [17]. They used crude *Haemonchus* adult antigen which proved 87.5% sensitivity and 75%, a specificity. *H. contortus* somatic antigen was purified using gel filtration column chromatography and three purified fraction were obtained. In a vaccination trial these bands were success in the reduction in fecal egg counts and worm burden in experimentally infected lambs. It might be utilized in diagnosis of haemonchosis [38]. Furthermore, Kandil et al. [39] used the immune-reactive protein profile of different prepared *H. contortus* antigens and the indirect-ELISA test for serological diagnosis of haemonchosis. Larval antigen is the prospective antigen for such serological diagnosis. Immuno-dominant reactive band at 57 kDa were liable for high specificity and precision of positive predictive value of this antigen. In addition, larval and excretory secretory antigens showed the highest apparent prevalence values (92 and 75%, respectively). Recently, the indirect ELISA was used for investigation of [40] the early changes in Th1 and Th2 cytokines for diagnosis of strongyle infection in equines with estimation of diagnostic accuracy values; percentage of immunoglobulin G, sensitivity, specificity, positive predictive value, and negative predictive value of different prepared strongyles antigens CSS (crude somatic *S. vulgaris*), ESS (excretory secretory *S. vulgaris*), CSC (crude somatic Cyathostomins) and ESC (excretory secretory Cyathostomins). Lowest 37.81% and highest 437.04% IgG in low and high egg-shedder groups when using CSS and ESC antigens, respectively. Cattle are considered the intermediate hosts of *T. saginata*, the larval form (metacestode) characterized by the localization in the muscles of infected animals [41]. A more effective method of identifying *T. saginata* metacestodes in bovine lesions has been applied by Ogunremi and Benjamin [19].

They used a complex stain (avidin–biotin and monoclonal antibody to *T. saginata* with dianobenzidine chromagen and hematoxylin counter stain) against a secretory product of *T. saginata* metacestodes. Degenerated cysts and viable were identifiable after immunohistochemical staining and could be differentiated from other cysts like *Actinobacillus*, *Sarcocystis*, or normal bovine structures.

**Echinococcus** species is the most important tape-worms and measured about (3-6 mm long). It is live in the small intestine of carnivorous definitive hosts, such as wolves and dogs, while, cyst stages (echinococcal cyst) are found in intermediate hosts, such as cattle, sheep, goats, camels, pigs, and horses and are called cystic echinococcosis (CE). Due to cross-reactivity with

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other species of taeniid cestodes [42] or to other helminths [43], accurate serological diagnosis of CE infection is difficult. In sheep, which is considered as the main intermediate host of *E. granulosus* in most countries of endemic infection [36], antibodies can be detected at 4 to 6 week post infection [44] and persist for at least 4 years [45]. Indirect-ELISA and WB techniques were used to recognize a specific protein of hydatid cyst fluid (HCF) antigen by CE-infected sheep sera. Three antigens; a crude protoscoleces preparation, a recombinant EG95 oncosphere protein and purified 8kDa hydatid cyst fluid protein (8kDa) were adopted for diagnosis of sheep CE, the ELISA test showed highest diagnostic sensitivity with protoscoleces antigen followed by 8kDa HCF protein then protein of recombinant EG95 oncosphere. They revealed that the diagnostic specificities were ranged from 96 to 99% and the immunogenic reactive bands in the crude protoscolecs antigen preparation were ranged from 70 to 150 kDa [46, 47]. Furthermore, Jeyathilakan et al. [48] demonstrated that the WB assay was the most accurate test (99%) for the detection of CE in sheep by using 8 kDa hydatid cyst fluid antigen. ELISA and Dot-ELISA were used [49] for diagnosis and detection of circulating antigen of cystic echinococcosis in buffaloes. The specificity and sensitivity were determined as 92 and 89%, respectively for ELISA, whereas those of Dot-ELISA were determined as 96 and 94% respectively. ELISA was adopted to detect the total specific *E. granulosus* IgG and IgG subclasses antibodies of human CE by using hydatid cyst fluid antigen (HCF) obtained from camel. It showed high sensitivity for such diagnosis [50]. In addition, Ramadan et al. [51] applied enzyme linked immune electro transfer blot assay (EITB) for diagnosis of 47 pulmonary CE cases by adopting human and camel HCF antigens. They found that a six antigens with molecular weights 5, 7, 20, 28, 35 and 127 kDa exhibited diagnostic efficacy. They were strongly recognized by all CE patient sera and the camel HCF antigen proved 100% sensitivity and specificity. Moreover, HCF partially purified antigen of camel origin recorded 100% sensitivity in serodiagnosis of hydatidosis in camel and donkey using ELISA, and the specificity was 97.6 and 95.9%, respectively [52]. Furthermore, HCF crude antigen of camel and sheep origin can be used in diagnosis human hydatidosis using immunoblotting analysis (IB), and recognized 11 major protein fractions [53].

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an intensive cross reaction between egg and ES antigens even when there was no cross-reaction with coproantigen.

**Molecular diagnostic techniques**

Nowadays, molecular techniques facilitate the diagnosis and identification of the parasites that were previously hard to be diagnosed by conventional techniques. Consequently, treatment can be easily applied before initiating large damage to the infected population. PCR-based methods can be joined with other techniques such as RFLP or nested-PCR for parasites genotypic. In addition, these combined methods can give a specific pathogens detection in stool sample. As well as, detection of low number of helminths parasite in stool samples by PCR is considered useful due to the higher detection sensitivity of PCR comparing to light microscope [61]. The advantage of PCR-based technologies is the detection of some parasites with high specificity and sensitivity. The major disadvantage is the necessity of prior information about the target sequence to produce the primers that will permit its selective amplification. Also, PCR are very time-consuming and cannot give quantitative data. Advanced PCR-based methodology was improved which is the quantitative real-time PCR (RT-PCR) [61]. It considered a sensitive method for detection and identifying protozoa in human feces samples [61]. Unlike standard PCR. It is characterized by avoiding using gel-electrophoresis method. This technique therefore usually provides more rapid results and / or uses fewer reactants [62]. In addition, random amplified polymorphic DNA (RAPD) technique is a type of PCR. It characterized by the random amplification of DNA segments. It has been broadly applied for characterization of parasite strains in epidemiological studies [63]. RAPD is the method used to describe strains and determine the genetic structure of microorganisms [64]. It shows high efficiency of amplification profiles such as studies on parasitic nematodes of humans and livestock. Also, it has been applied to map genes for differentiation of species [65]. RAPD enabled the differentiation of endemic Wuchereria strains in Asia [66]. Sharbathkori et al. [67] used RAPD to differentiate 112 isolates of *E. granulosus* in ruminants. In addition, Bobes et al. [68] determined the genetic variability of *T. solium* in some locations of USA. RAPD is uncomplicated, rapid, and low-priced test that does not require previously information about the DNA sequence or DNA hybridization [66, 69]. Studying the genetic structure of organism by RAPD assay is useful because it detects polymorphisms in the noncoding regions of the genome [64].

**LAMP** (Loop-mediated isothermal amplification) is an isothermal nucleic acid amplification technique. It does not require a thermal cycler like conventional PCR, and it is carried out at a constant temperature [29]. This technique could be used to amplify limited copies number of target DNA in less than one hour [70]. For example, it can be used to produce rapidly a twenty microgram of DNA from twenty five microliter reaction mixture in 1 h under isothermal conditions with great specificity and sensitivity [30]. LAMP technique is helpful in detection of many parasitic agents such as *Taenia, Schistosoma* and *Fasciola* spp [29, 30, 70]. LAMP method (88%) is more sensitive than PCR (37%) in differential recognition of *Taenia* in stool samples. So, it is considered a golden tool for detection of taeniasis [22]. In addition, it has a prospective clinical application in differentiation of *Fasciola* spp. in endemic areas. It was ten times more sensitive than conventional PCR in amplification *Fasciola* spp. DNA in stool samples and in mollusks (intermediate hosts) [71]. LAMP is simple and applicable tool for small laboratories. It only needs simple devices as water bath or heat block for amplification of target DNA. There is no need for long cycles and varying temperatures of thermal cyclers. Thus, LAMP method seems to be a promising tool where it is more specific and faster in time than conventional PCR [70].

Restriction fragment length polymorphism (RFLP) was used to detect the variations in homologous DNA sequences [72]. It is commonly used for genotypes of parasites and diagnosis of species [63]. Differential diagnosis of dog hook worms by RFLP was applied [73, 74]. The RFLP is appropriate for environmental samples because it can detect multiple genotypes in the same sample. It is an important tool in genome mapping and localization of genes for genetic disorders and determination of risk for disease [63].

Microsatellites is known as short DNA sequences (about 300bp) which are composed of tandem repeats of 1 -6 nucleotides with about 100 repeats [75]. Microsatellites are abundant in genomic eukaryot and can rapidly mutate by losing or gaining repeat units [14]. In parasitology, microsatellites have been used to describe some parasites of both humans and animals. There
are many studies have been concerned with mitochondrial DNA markers, and microsatellites autosomal markers have been applied only to a nematode species, like Trichostrongyloid [31]. Microsatellites have wide diversity of applications because they display frequent polymorphism, high reproducibility, codominant inheritance and high resolution, need easy typing methods, and can be observed by PCR [75]. Due to the high number of microsatellites, these genetic markers have low popularity which cause technical difficulties in isolating parasites by PCR [14, 31].

**Diagnosis of Nematodes based on molecular techniques**

Traditional techniques for diagnosis of the helminths infection in sheep need exhausted laboratory extraction, examination of eggs by culture and microscope. Recent molecular technique provides the potency for more reliable and efficient methods. A combined molecular approach and microscopic examination of strongylid infection in sheep were applied [76]. This method is depending on the isolation of nematode eggs from faecal samples using flotation technique. Specific and semi quantitative genomic DNA amplification from of T.circumcincta, H. contortus,., Cooperia oncophora, Trichostrongylus spp., O. venulosum and Chabertia ovina Oesophagostomum columbianum, are achieved [76]. This method showed that there was a correlation between numbers of egg per gram of faeces and cycle threshold values in the PCR, so permitting the semi-quantitation of parasite DNA in faeces. This combined method provides a useful tool for diagnosis and epidemiological surveys. In addition, Learmount et al. [28] tested the validation of a RT- PCR method for diagnosis of T. circumcincta and H. contortus in sheep. A strong correlation has been found between the numbers of eggs determined by the traditional and the molecular methods.

The eggs of cyathostomins in faecal samples were determined by larval cultures but the differentiation of cyathostomins group to species or genus level doesn’t determined by this culture. So detection of cyathostomins in faecal samples have been applied by molecular techniques. This includes PCR-ELISA and RLB assays. Twenty one cyathostomin species have been characterized by RLB assay [27]. Assays like these exclude the use of classical morphological identification, which are time-consuming, need special skills, and applied on the adult stage only. As both the RLB assay and the PCR-ELISA can be applied on any parasitic stage [26]. Traversa et al. [77] applied the RLB assay to identify thirteen species of cyathostomins (equine small strongyles) and discriminated them from three large strongyles (Strongylus spp: S. edentatus, S. equinus, and S. vulgaris) by. This RLB method explain some aspects of cyathostominosis and promises to be an excellent diagnostic technique of individual species in the pathogenesis of mixed infections [77].

Recently, two diagnostic methods, RT-PCR and larval culture –method, for the detection of infections with S. vulgaris in equine faecal samples were compared [78]. The RT-PCR demonstrated that DNA of S. vulgaris was 1.9% in ten of 501 equine samples. However, the larval culture revealed 1.1% larvae of S. vulgaris in three of the 278 samples. The RT-PCR should consequently be considered as a good diagnostic tool for S. vulgaris in equine samples. Also, Kandil et al. [79] investigated the genetic diversity among and within H. contortus in Egypt by PCR technique. H. contortus causes significant economic losses in small ruminants worldwide. PCR technique revealed that all worms have one genotype (ITS2) without genetic differentiation. This result could have implications for the rapid characterization of H. contortus and other trichostrongyloid.

**Diagnosis of Cestodes based on molecular techniques**

PCR technique have been applied for diagnosis of T.saginata and T.solium from different geographical locations [80]. This PCR analysis of DNA isolates confirmed morphologic diagnosis with proportionate and clear interspecies differences between T. solium (3 samples) and T. saginata (22 samples) isolates. Within these species, possible intra-species genomic variability was similarly studied through PCR-RFLP and only one T. saginata isolate from Kenya was performed, different from T. saginata DNA of Spanish (7 samples) origin and Mexican (1 sample). Also, a nested PCR have been applied for T. solium DNA detection. The assay’s specificity and sensitivity were 100% and 97%, respectively with archived samples. However, both the sensitivity and the specificity of the assay were 100% when the nested PCR was tested in the field [80].
Also, molecular techniques can consider a valuable tool in the study of *E. granulosus* epidemiology. Boubaker et al. [81] used PCR assay to detect the genus *Echinococcus*. The genetic variation of *Echinococcus* species can reflect contrasts in infectivity for specific host species. Hence it is of huge significance to phylogenetically portray *E. granulosus* population structure [82]. Omar et al. [83] presented the molecular characterization of *C. tenuicollis* of *Thydatigena* from livestock isolates in Egypt. PCR assay revealed that there was high similarity between sheep and goat samples (the 340 base pair fragment that corresponds to the mitochondrial *COI* gene). While more frequently differences were found in the camel samples (10 bp). Obviously, diagnosis for *C. tenuicollis* infection by molecular help to differentiate it from such other metacestodes as hydatidosis, which requires different control programs.

Determination of the genotypes of *E. granulosus* in farm animals of Egypt and Italy have been done by Kandil et al. [84]. The rapid diagnosis and characterization of *E. granulosus* genotypes were done by a specific and sensitive PCR, semi nested PCR system. Characterization of genotypes G1 for sheep, cattle and goats whereas G6 for camel. This study identified as the *E. granulosus* G1 genotype (from Egypt and Italy), and 2 isolates (both derived from camel in Egypt) belonged to the G6 genotype. These data indicated some epidemiological features and molecular characteristics of *E. granulosus* in Egyptian and Italian farm animals.

**Diagnosis of trematode based on molecular techniques**

RAPD-PCR assay used to characterize *F. gigantica* isolates from cattle in different localities [85]. This study represented the variability of *F. gigantica* isolates from the same host and using RAPD markers could be applied as a low cost way of identification. Three different methods were applied to diagnose *F. hepatica* infection in naturally and experimentally infected sheep [86]: coprological method, S- ELISA kit assay and standard and nested PCR assays. The percentage of infection at 4 weeks post infection (wpi) was 57.1% then reached 100 % at 8wpi by S- ELISA kit assay. All naturally infected animals were positive with this method. However, the *F. hepatica* infection was 82 % at three wpi with a PCR, and from two weeks with a nested-PCR. This study concluded that the sensitivity of the nested-PCR is higher than the commercial immunoassay. Also, no cross reactions were related with GI nematodes. In addition, Ayaz et al. [87] demonstrated that prevalence of fasciolosis in buffaloes and cattle was higher in abattoir of district in Pakistan and PCR was a more sensitive method of diagnosis than microscopy. Identification and differentiation of the two species of *Fasciola* for epidemiological applications. Molecular assay to differentiate between both *F. gigantica* and *F. hepatica* in cattle and sheep has been applied [88, 89]. PCR and sequencing amplicons revealed that there was no variation of the 18s rRNA sequence among the multiple samples from cattle and sheep if compared to the corresponding sequences in the gene bank. However, six nucleotide differences were detected between *F. gigantica* and *F. hepatica* isolated in Egypt. These differences among the *Fasciola* spp. can be utilized as molecular markers for diagnosis of fasciolasis in Egypt [89]. Also, a molecular methods based on the detection of *F. hepatica* DNA in faeces which collected from natural infected cattle and sheep were applied by Arfin et al. [90]. Arfin et al. [90] applied LAMP and the performance of PCR in diagnosis of *F. hepatica* from naturally infected sheep and cattle (53 animals). In this study, the serology coproantigen ELISA (cELISA), and the outcomes of faecal egg count (FEC), were compared with LAMP and the performance of PCR in diagnosis of *F. hepatica*. DNA- faeces samples were examined both by LAMP and PCR. This results revealed that only 6 and 3 samples were positive by LAMP and PCR, respectively.

Infection of GIT with *Paramphistomum spp* has a great prevalent in domestic ruminants worldwide. Paramphistomosis infections resulting in morbidity, mortality, and reduced meat, wool, and milk production. Approximately 40 species of paramphistomes have been reported, but the dominant species are *Gastrothylax crumenifer, Gigantocotyle explanatum, Paramphistomum cervi*, and *Fischoederius elongates* [91, 92]. The identification based on morphological features of these trematode helminths is very difficult [93]. To discriminate among different species a molecular characterization is necessary. Polymorphic DNA fingerprint analysis of three different species of paramphistomes isolated from the rumen and bile ducts of buffaloes were performed. The ruminal paramphistomes were identified as *Pcervi* and *G. indicus*, while the hepatic paramphistomes were identified as *G.bathycotyle*. The RAPD fingerprint suggested close relatedness between...
G. bathycotyle and G. indicus as compared to P. cervi. This study concluded that the RAPD can be used successfully to identify various species of parasite and it is a simple way of creating genomic DNA “fingerprints” [93].

**Conclusion**

Helminths infection of the GIT involve the three main groups: nematodes, cestodes and trematodes. Although the traditional methods of diagnosis are specific, they are time consuming, laborious and lacks sensitivity especially in case of light infection. ELISA and its modifications were the commonly used assay in detecting host immune responses and parasite antigens together with western blotting. In addition, advanced molecular techniques are excellent and recommended for laboratory-based research that lead to improve the accuracy and sensitivity of helminths identification and characterization. The accurate diagnostic techniques, immunological and molecular, are urgently needed not only for diagnosis but also for treatment follow up.

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Advances Techniques in the Diagnosis of Helminthes …

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The techniques of advanced diagnosis of helminthes for livestock

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Treating helminthiasis is one of the most common and primary diseases that affect humans and animals, leading to malnutrition and anemia. The helminthiasis infection is divided into three groups: nematodes (roundworms), tapeworms, and flukes (flukes). Infection with roundworms and tapeworms leads to acute inflammation in the stomach and intestines, while infection with flukes affects the liver and the biliary system. The infection generally occurs through the oral route, but its route varies in the intermediate and final hosts. Diagnosis is usually done using simple techniques such as direct examination of the sample or using a flotation or sedimentation technique. These methods take a long time and their sensitivity is low in detecting the degree of infection.

It is considered appropriate to use immune methods such as ELISA and its variations in diagnosis, as it has shown effectiveness in diagnosing infections with Strongyloides and Taenia species in sheep and Anisakis infection in cattle. It also showed that ELISA indirect and also immune blot were able to detect infections with Strongyloides and Taenia species in sheep and Anisakis in cattle. PCR (Polymerase Chain Reaction) is also considered an advanced technique in using biophysical means like continuous fluorescence, LAMP (Loop-mediated Isothermal Amplification), and RT-PCR (Reverse Transcription PCR) to detect helminthes infections, which have shown high sensitivity and specificity in detecting and diagnosing many species of helminthes. PCR is also considered one of the most accurate techniques in diagnosing Strongyloides species in fecal samples, and it can also be used to detect helminthes infections in saliva samples through direct detection.

Finally, there is a need for the use of modern techniques not only in diagnosis but also in monitoring treatment.