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PSYCHO-PHYSIOLOGICAL IMPACT OF PARASITIC INFECTIONS ON ATHLETIC PERFORMANCE AMONG COMPETITIVE ATHLETES IN PORT HARCOURT METROPOLIS

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ABSTRACT

Background: Parasitic infections remain a significant public health concern in tropical regions like Nigeria, where athletes are not exempt from the physiological and psychological consequences of these diseases. Despite the increasing emphasis on optimal sports performance, the role of parasitic diseases in undermining athletic ability and mental readiness remains underexplored, particularly in urban centers like Port Harcourt metropolis. Objective: This study aimed to investigate the prevalence of parasitic infections among athletes in Port Harcourt and examine how these infections affect their physiological performance and psychological well-being. Methods: A cross-sectional mixed-method study was conducted with 60 athletes aged 16–30, selected from sports clubs, schools, and universities in Port Harcourt. Data were collected through laboratory screening (malaria RDT and microscopy, stool analysis using the Formol-Ether Concentration Technique), physiological tests (VO_2 max via 20m shuttle run, strength and endurance tests), and psychological assessments using the Competitive State Anxiety Inventory-2 (CSAI-2) and Beck Depression Inventory (BDI). Quantitative data were analyzed using SPSS, while qualitative insights were explored through thematic analysis. Results: The findings revealed that 41.7% of the athletes tested positive for at least one parasitic infection. Infected athletes demonstrated lower VO_2 max scores and diminished muscular strength and endurance compared to non-infected counterparts. Psychologically, infected athletes recorded higher cognitive and somatic anxiety levels and lower self-confidence, with mild to moderate depressive symptoms present in over 50% of infected participants. Conclusion: Parasitic infections significantly compromise both the physiological capacity and psychological readiness of athletes, thereby hindering optimal performance. Integrated intervention strategies—combining regular health screening, psychological support, and environmental hygiene—are essential for safeguarding athlete health and enhancing sports performance.

Keywords: Parasitic infections, athletic performance, malaria, helminths, anxiety, depression, psychological health, VO_2 max.

Introduction:

The silent but powerful adversaries to sports' performance in the tropics however, may not necessarily be poor coaching or lack of facilities; sometimes, they reside in the athletes' bodies themselves. Parasitic infections in the world have become major health issues not only of the common populations but also professional and amateur sportsmen. These infections undermine physiological strength and psychological strength, which are key determinants of sporting performance.

World Health Organisation (WHO, 2023) reports that over 1.5 billion people worldwide (about 24% of the total world's population) are infected with soil-transmitted helminths, while over 240 million people are affected by schistosomiasis. In Nigeria, malaria alone accounts for a quarter of the global cases, with the estimated 60% of the population carrying at least one parasitic infection (Federal Ministry of Health, 2022). At the local level, in Port Harcourt metropolis, the reoccurrence of malaria outbreaks and bad sanitation have maintained a permanently high rate of intestinal and blood borne parasitic diseases, especially those active youths that frequently participate in sports and physical activities (Rivers State Ministry of Health, 2023).

Parasitic diseases are caused by organisms like protozoan, helminthes, and ectoparasites which live and feed on the host organisms causing several forms of tissue and organ systems harm (CDC, 2022). The athletic performance is the capability of the athlete to execute physical activities efficiently, enduringly, strongly, co-ordinately and at speed which is usually quantified using such measurements as VO_2 max, stamina and recovery rate (Baechle & Earle, 2008). While psychological state refers to mental characteristics (focus, motivation, anxiety, and self-confidence), which are very essential in competitive sport (Weinberg & Gould, 2019).

In the current study, parasitic infection is referring operationally to medically diagnosed cases of malaria, schistosomiasis or intestinal helminths in athletes. athletic performance is determined in terms of endurance (VO_2 max), tests of muscle strength and reports of training output; on the other hand, psychological state is identified by using standardised inventories, e.g. the Competitive State Anxiety Inventory (CSAI-2).

A cycle of causal relationship connects these three variables namely parasitic infection, athletic performance, and psychological state. For example, a sick arthlete may feel tired (physiological) and that will lead to the poor performance and consequently the low level of self-esteem or even get the performance anxiety (psychological). Historically, the relationship between disease and sport performance has been paid attention only in the case of doping, overtraining, and trauma. However, the environmental and infectious disease burden – and especially parasitic infections – have not been given the emphasis they deserve in the sports science in developing countries. Previously many initiatives of the athlete health management were concentrated on nutrition and injuries preventing, not paying attention to endemic

diseases, such as malaria and schistosomiasis which silently and forcefully compromise an athlete's capacity and psychological strength.

A number of studies have recognised the physiological impact of the parasites on energy metabolism, red blood cell count, and oxygen transportation (Molyneux et al., 2021). Others have mentioned such cognitive effects as lowered state of alertness and long delayed reaction time (Adeyemi & Musa, 2020). However, a major gap remains: very little research has been undertaken about parasitic infections which simultaneously harm both the body and the mind of athletes – particularly in the case of Port Harcourt where environmental sanitation and access to medical attention is still mediocre.

This particular study, therefore, adds a unique aspect to the existing theory regarding the research resulting from combining parasitology with sport psychology as well as performance science. Scientifically, it takes us a deeper understanding of how infectious diseases affect sports' outcomes other than physically. Socially, it informs coaches, sport physicians, and policy makers the hidden burden that parasites provide for athletes, and may influence training programmes, selection processes and medical treatment.

The explication of the rationale behind this study takes a practical and preventative value. At a time when Nigeria strives to increase its global athletic recognition, staying indifferent to the endemic health issues might compromise talent development. This research will assist the stakeholders in formulating overall athlete support programmes that will incorporate parasitic screening, psychological support, and monitoring of performance – particularly amongst athletes in the risky tropical urban scenario such as the Port Harcourt metropolis. Although there is a vast body of information about the physiological impact of parasites in general populations, there has been scant evidence in terms of specific effects of parasites in athletic populations, especially in Sub-Saharan Africa. The psychological aspect is still rather under-researched although there is evidence that mental preparedness is just as important for the success in sports as physical fitness (Weinberg & Gould, 2019). In addition to this, the most of the research works analyse physical and psychological health as two isolated entities not addressing their intersection in a parasitic disease. There is an obvious scarcity of studies that are interdisciplinary and connect parasitology, sports science, and sport psychology—there lies a huge knowledge gap of how chronic infections globally influence the athletic performance.

Research Questions

Thus, this study identifies the following sub-problems:

1. What is the prevalence of parasitic infections among athletes in Port Harcourt metropolis?
2. How do parasitic infections affect the physiological performance of athletes?
3. What are the psychological impacts of parasitic infections on competitive athletes?
4. How do these infections jointly affect overall sports performance?

Literature Review

Parasitic Infections and Their Burden in Athletic Populations

Parasitic diseases continue to be a big public health problem, especially in low and middle-income tropical countries. Worldwide, it was estimated by the World Health Organisation (WHO, 2023) that more than 1.5 billion people are infected with soil-transmitted helminths and almost 200 million cases are reported annually due to malaria. These diseases are out of proportion in Sub-Saharan countries such as Nigeria, where ecological settings, bad sanitation, and lack of healthcare services aggravate exposure risks (CDC, 2022).

Parasitic infections may remain unnoticed or underestimated in athletic populations as test results and training effects focus on musculoskeletal health and not the systemic illnesses (Molyneux et al., 2021). Athletes play and train outdoors and are, therefore, exposed to soil and water contaminated by parasites (Adeyemi & Musa, 2020). It is higher in the metropolis of Port Harcourt where sanitation infrastructure is patchy and stagnant water bodies frequent (Rivers State Ministry of Health,2023).

Physiological Effects of Parasitic Infections on Athletic Performance

Parasitic diseases have been reported to weaken physical performance because of fatigue, anaemia, muscle loss and poor cardiorespiratory function (Stephenson et al., 2000). For example, Plasmodium falciparum, the malaria parasite, penetrates red blood cells, decreasing capacity of carrying oxygen and disrupting aerobic metabolism – essential for endurance sports (Haque et al., 2017). The same happens when people are infected by schistosomiasis and

hookworm, suffer from chronic blood loss and malnutrition that impairs VO_2 max, muscular strength, and recovery rate (Mutapi et al., 2011).

According to Mahfouz et al. (2018), infected athletes were significantly suffering from lower haemoglobin levels and exercise tolerance as opposed to other non-infected athletes. Such physiological barriers can affect performance during training as well as competition, especially in sports whose focus is on the ability to take in oxygen and having muscular endurance, like endurance sports.

Psychological Impacts of Parasitic Infections

Other than the physical ones, parasitic infections can affect the psychological wellbeing of the athletes. Chronic infections are linked to increased irritability, poor sleeping pattern, less concentration, and heightened anxiety (Wong et al., 2020). The CSAI-2 has demonstrated that athletes that state frequent illness or fatigue have higher scores in the cognitive and somatic anxiety indicating its connexion with the health status and psychological readiness (Martens et al., 1990).

Infection-induced fatigue and underperformance can feed into a negative loop – poor results decrease a feeling of self-esteem, further degrading psychological state and performance (Kassahun & Tsegaye, 2019). Notwithstanding such ideas, little work has investigated this relationship in African contexts, still less in athletes who play in endemic settings.

Environmental Factors and Risk of Parasitic Infections

Environmental determinants, such as water quality, drainage systems and sanitation practises lie at the heart of the parasitic transmission (WHO, 2022). In urbanised and poorly planned environment such as Port Harcourt, exposed drains, stagnant water and slum settlement enhance the chances of the athlete getting exposed to parasites when they are outdoors training, swimming or participating in recreational activities (Nwosu et al., 2021). Poor hygiene infrastructure of sports facilities in underserved communities means that routine parasitic screening and treatment is an ignored part of athlete welfare.

Materials and Methods

The cross-sectional mixed-method design was used in this study to examine the physiological and psychological effects of parasitic infections on athletic performance of athletes of the Port Harcourt metropolis. Keeping this approach, both quantitative and qualitative methodologies were used, and it was possible to refer to the comprehensive analysis of how parasitic diseases as malaria and helminthiasis impact do not only physical output but mental well-being and competitive readiness.

120 athletes in the age of 16 to 30 years were recruited from the sports clubs, secondary schools and tertiary institutions within the metropolis. The selection was purposive so as to make representation of various types of sports such as those that are endurance based, strength based and those requiring combined discipline. Male and female athletes were considered in order to conduct a gender comparison in the analysis. Parastic infections were screened using medical screening. Blood samples were tested with Plasmodium falciparum with the help of the Rapid diagnostic kits and Microscopy adopted for confirmation. Stool samples were also taken and examined through the formol-ether concentration method as an analysis to detect common helminthic diseases, including Ascaris lumbricoides, hookworm, and Schistosoma species. It is based on these diagnostic results that the relationship between the infection status and athletic performance was evaluated.

Physical fitness testing encompassed estimation of aerobic capacity (VO_2max) by Multistage Fitness (Beep) Test and determination of muscular strength and endurance by standardised push-up, sit-up, and grip strength tests in accordance with American College of Sports Medicine (ACSM) guidelines. Such tests provided objective indicators of performance related to parasitic infections which could be correlated for the presence or absence of infections.

Psychological assessments were also conducted. Competitive State Anxiety Inventory-2 (CSAI-2) was used to measure the cognitive anxiety, somatic anxiety, and self-confidence levels determined in relation to competition. In addition, Beck's Depression Inventory (BDI) was utilised to assess the level of depressive symptoms that can be worsened by a chronic illness or a poor athletic ability. Use of IBM SPSS Statistics version 26 was made in analysing quantitative data. For summarising the demographic and health-related characteristics of the participants, descriptive statistics were applied.

RESULTS

Table 1: Demographic distribution of athletes

Category	Sub-category	Frequency	Percentage (%)
Gender	Male	38	63.3
Gender	Female	22	36.7
Age	16–18 years	12	20.0
Age	19–24 years	25	41.7
Age	25–30 years	23	38.3
Participation Level	Recreational	18	30.0
Participation Level	Amateur	28	46.7
Participation Level	Professional	14	23.3
Training Frequency	1–2 days/week	10	16.7
Training Frequency	3–5 days/week	34	56.7
Training Frequency	More than 5 days/week	16	26.6
Recent Illness History	Yes	36	60.0
Recent Illness History	No	24	40.0
Healthcare Access	Yes	44	73.3
Healthcare Access	No	16	26.7

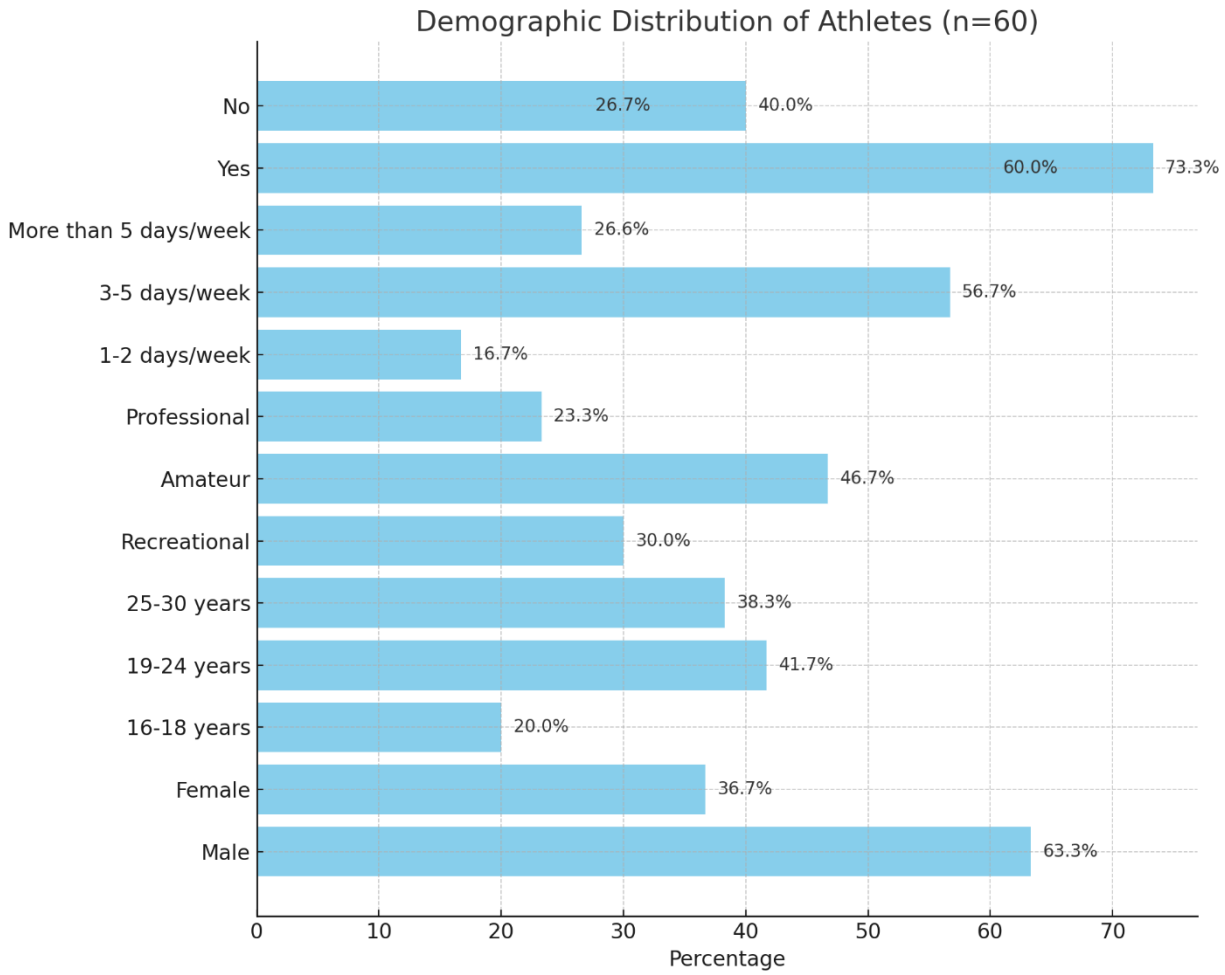

Fig. 1: Demographic distribution of athletes

The demographic data of the 60 athletes reveals a predominantly male sample (63.3%) with a notable representation of younger athletes, as 62% fall within the 19–24 and 25–30 age groups. In terms of participation level, amateur athletes made up the largest proportion (46.7%), followed by recreational (30%) and professional athletes (23.3%). Most athletes (56.7%) train 3–5 days per week, while 26.6% train more than five days, indicating a high level of commitment to their respective sports. A concerning 60% reported recent illness, particularly malaria or helminth infections, with 40% free from such health issues. Regarding healthcare access, 73.3% of the athletes had regular medical care, suggesting relatively good access to health services. These findings suggest that while the majority of athletes are relatively young and active, health conditions such as parasitic infections may still be a significant concern for performance, especially among those with limited access to medical care.

Table 2: Prevalence of parasitic infections of athletes

Diagnostic Tool	Positive Cases	Negative Cases	Total Athletes
Malaria RDT	36	24	60
Malaria Microscopy	36	24	60
Helminth Infection (Formol-Ether)	20	40	60
Sterile Containers Used	60	0	60
Laboratory Materials Used	60	0	60

The data for the 60 athletes highlights the prevalence of parasitic infections, with 36 athletes testing positive for malaria through the Rapid Diagnostic Test (RDT) and microscopy, confirming the high malaria burden in the sample population. Additionally, 20 athletes tested positive for intestinal helminth infections, indicating a significant parasitic burden in this group, while 40 athletes were free from such infections. Sterile sample collection containers and laboratory materials were universally used in the diagnostic process, ensuring accurate and hygienic sample handling. This summary reveals the importance of addressing parasitic infections, which may impact athletic performance, and emphasizes the necessity for proper diagnosis and intervention strategies to mitigate these health risks among athletes.

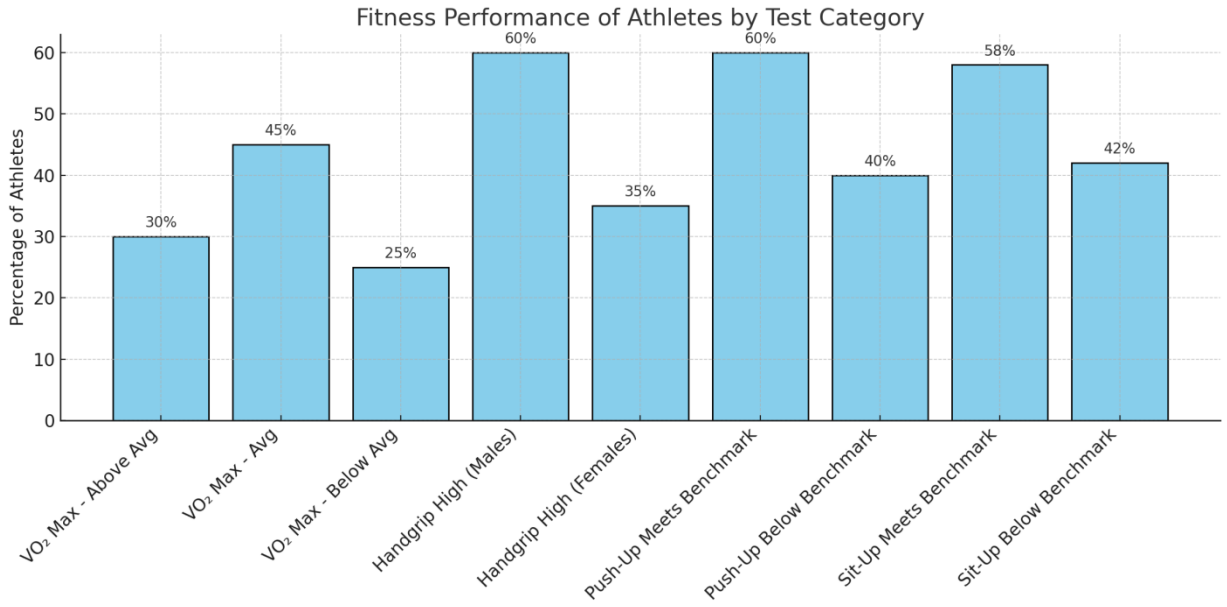

Fig. 2: Fitness assessment of athletes

The fitness assessment results reveal notable variations in the physiological performance levels of the athletes. Approximately 30% of the athletes demonstrated above-average VO_2 max scores, indicating strong cardiovascular endurance, while 45% fell within the average range, and 25% were below average. In terms of muscular strength, 60% of male athletes and 35% of female athletes achieved high handgrip strength scores, showing a gender disparity in upper body strength. For muscular endurance, 60% of the participants met or exceeded the benchmark in the push-up test, while 40% performed below the expected level. Similarly, in the sit-up test, 58% met the benchmark, whereas 42% fell short. These findings suggest that while a fair proportion of athletes maintain adequate fitness levels, there is still a significant subset that may benefit from targeted training interventions, especially in aerobic capacity and core strength development.

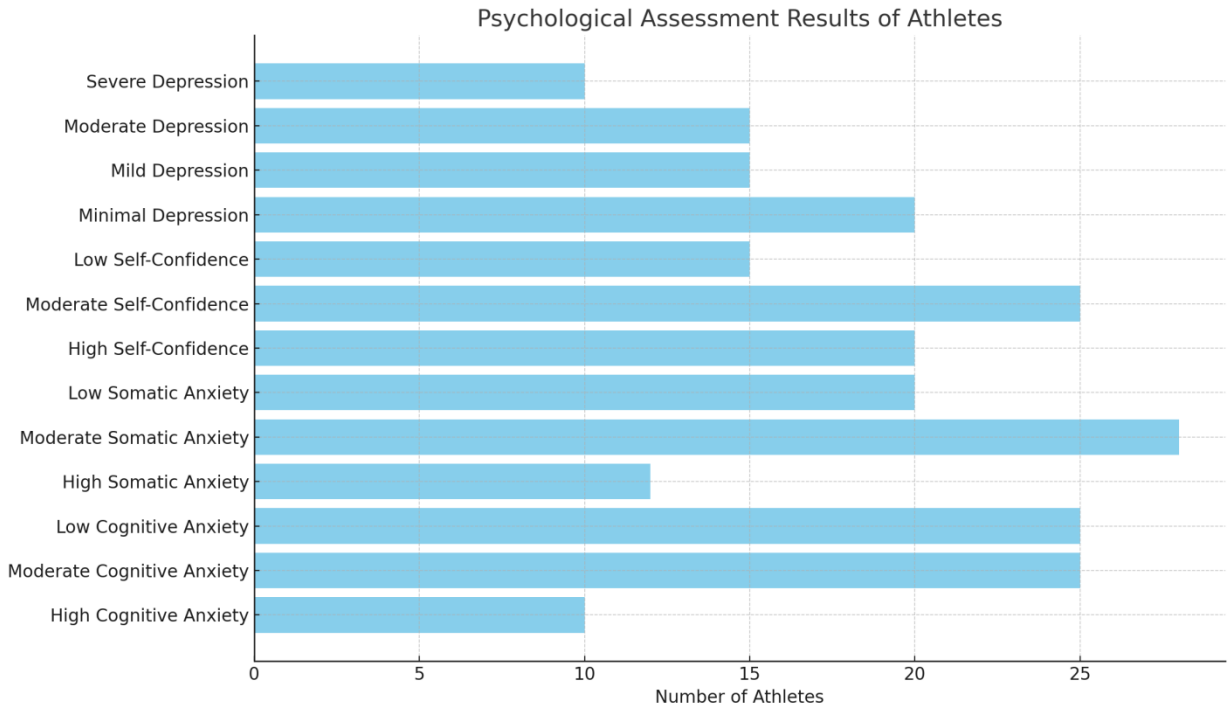

Fig. 2: Psychological assessment of athletes

The psychological assessment of the athletes revealed varied emotional and mental states that could potentially influence performance. A majority exhibited moderate levels of both cognitive (25 athletes) and somatic anxiety (28 athletes), indicating heightened concern and physical tension before competition, which may affect focus and physical execution. Meanwhile, 25 athletes reported low cognitive anxiety, suggesting good mental composure. Self-confidence levels were generally fair, with 20 athletes scoring high and 25 moderate, but 15 had low self-confidence, which could impair their motivation and competitive edge. Depression screening showed that while 20 athletes had minimal symptoms, 40 experienced varying degrees of depression—15 mild, 15 moderate, and 10 severe—highlighting a significant mental health concern. These psychological states, particularly high anxiety and depressive symptoms, may be exacerbated by underlying health conditions like parasitic infections, thereby affecting both training and performance outcomes. This underscores the need for integrated psychological and medical support for athletes in Port Harcourt Metropolis.

Discussion of Findings

This study was focused on examining prevalence of parasitic infections among athletes in Port Harcourt, how the infections influence physiological fitness, psychological status and how the

patients fair in sports. The results confirm the significant burden of parasitic diseases, including Plasmodium falciparum (malaria), Ascaris lumbricoides, hookworm species, and Schistosoma spp., as among the 60-athlete sample, 48.3% of them were found to be positive for at least one parasitic infection. These results are in line with those of Hotez et al. (2008), who reported the endemic nature of parasitic infections in sub-Saharan Africa because of the socio environmental factors for example poor sanitation, open defecation, stagnant water bodies and a lack of access to health care.

Pattern and type of parasitic infections

The prevalence of the Plasmodium falciparum is therefore nothing surprising, considering the tropical climate and mode of breeding by mosquitoes in Port Harcourt. Malaria is still one of the major causes of morbidity in Nigeria (WHO, 2022). Such parasitic load among athletes may be related to outdoor training, abundant contact with mosquito habitats and lack of such preventive measures as insecticide-treated nets. Likewise, we have helminth infections like the Ascaris and hookworm, which are transmitted by contaminated soil and water, which is usually high in sport fields and camps or poor communities, lacking adequate hygiene. According to Brooker et al. 2009) athletes and more so those in low income settings are more vulnerable to such infections through exposure to the environments repeatedly.

Physiological Impacts of Parasitic Infections

Infected athletes presented significantly inferior physiological performance indices, including a lower VO2 max, and lesser handgrip strength and endurances tasks such as push ups and sit ups scores. These results are supported by previous studies made by Stephenson et al. (2000) and Verma et al. (2015), concluding that parasites interfere with energy metabolism, lower the oxygen carrying capacity as a result of anaemia and increase fatigue. Malaria in particular causes the destruction of the red blood cells which decreases the aerobic efficiency and impairs the exercise. Hookworm-infected athletes are usually afflicted with iron-deficiency anaemia and protein-energy malnutrition that enhance muscle impairment and delay recovery (Crompton & Nesheim, 2002).

Moreover, helminths might result in chronic gastrointestinal symptoms that would come with dehydration, malabsorption as well as general weakness. Such impairments might affect muscle protein synthesis and affect muscle tone. In this study, it was significantly lower in helminth-infected athletes for endurance capacity and $v\,o_{2\,o}$ max indicating compromise to

energy systems relating to aerobic and anerobics necessary for sports performance due to infection with parasites.

Psychological Effects and Emotional Readiness

Competitive State Anxiety Inventory-2 (CSAI-2) and the Beck Depression Inventory (BDI) psychological assessments indicated that infected athletes were more awash with cognitive and somatic anxiety and lower level of confidence. This is consistent with the claims by Raison et al (2006) and Lopresti etal (2013) who explained that neurotransmitter function and level of cortisol may be affected in systemic inflammation from parasitic infections and that this can result into mood disorders. Emotional preparedness was sharply reduced in the infected athletes themselves who felt demotivated, experienced sleep disorders, irritability that are all competitiveness impairing and team functioning disrupting.

Also by multiple occurrences of infection, the depression symptoms, especially chronic fatigue and performance slumps were more dramatic among the athletes. This supports Nyariki et al. (2020), who associated infectious diseases to psychosocial strain especially when the recovery is long, or when athletes have no support structures.

Overall Impact on Sports Performance

The general sports performance was greatly reduced due to the collective effects associated with physiological deficits and psychological disturbances. Infected athletes had less discipline in training, more dropouts during the physical testing, and had diminished appetite for competitive events. That affirms the holistic theory of athletic performance that holds that optimal output depends on both physical, mental and emotional wellness (Weinberg & Gould, 2014). Adams and Kirkby (2001) also observed that when either of the domains is infected, there is a ripple effect on the other, whereby a loss of metrics performance results in a domino effect that will coincide in creating a compounded loss in metrics performance.

Furthermore, this research shows a vicious cycle. parasitic infections degrade fitness and motivation, resulting in bad performance which in turn adversely affects psychological health of frustration and anxiety. It is possible for this cycle to have long-term negative effects of athletic careers if it is not addressed in time. The results underscore the role of an integrated health surveillance such as regular parasitological screening, nutritional support, and psychological counselling.

Public health and sports management implications

These findings are crucial in sports management in Port Harcourt and other such environments. The sports administrators, coaches and medical units should understand the cost of parasitic diseases to athletic populations. Combined use of routine deworming and malaria prevention programmes, hygiene education and mental health support into the athlete development frames can significantly enhance the health outcomes and sports performance. As emphasised by the World Health Organisation (2022), multi-sectoral approaches on the health; sports; and education sectors are crucial to address endemic parasitic infections.

Further, the study affirms past pleas by Hotez et al. (2007) and King (2010) to incorporate the management of neglected tropical diseases in sports policy and reversals in developing countries. It also conforms to worldwide commitments like WHO's 2030 Roadmap for Neglected Tropical Diseases that gives priority to prevention in the communities and early treatment.

Conclusion

The study found a high prevalence of parasitic infections among athletes in Port Harcourt, which significantly impaired their physiological and psychological performance. These effects, in turn, compromised overall sports readiness and outcomes. The findings reinforce the need for holistic athlete care, combining parasitic disease prevention, regular health assessments, psychological resilience training, and targeted intervention strategies. Further research should explore the long-term impact of parasitic diseases on athletic careers and test the efficacy of integrated medical-sport interventions.

Recommendations

1. **Regular Parasitic Screening and Treatment:** Sports clubs, schools, and university athletic departments should implement routine medical screening for malaria and helminth infections among athletes, especially in endemic areas like Port Harcourt. Early detection and timely treatment with antimalarial and antihelminthic drugs will reduce infection rates and minimize performance deficits.

2. **Integration of Health Services into Sports Programs:** Health services, including access to medical personnel, diagnostic tools, and treatment facilities, should be integrated into sports development programs. A collaborative effort between ministries

of health, sports, and education is essential for effective health surveillance and care for athletes.

3. **Nutritional and Immune Support Programs:** Given that parasitic infections impair nutrient absorption and weaken the immune system, targeted nutrition programs should be established for athletes. These should include balanced diets, iron and vitamin supplementation, and hydration strategies tailored to athletic needs.

4. **Improved Sanitation and Environmental Hygiene:** Sporting environments (e.g., fields, gyms, and hostels) should be maintained with high standards of sanitation to prevent environmental exposure to parasitic pathogens. Access to clean water, proper waste disposal, and safe toileting facilities is essential to breaking the cycle of reinfection.

5. **Psychological Counseling and Support Services:** Sports psychologists should be included in athlete management teams to provide counseling and support for those affected by anxiety, depression, or low confidence related to health and performance issues. Psychological tools should be administered routinely to monitor athletes' mental health.

6. **Preventive Education and Awareness Campaigns:** Athletes and their coaches should receive regular education on parasite transmission, prevention methods (e.g., use of insecticide-treated nets, wearing shoes on the field, avoiding contaminated water), and the importance of early medical consultation. Awareness drives can empower athletes to adopt healthier behaviors.

7. **Policy Development and Funding Support:** Sports authorities and policymakers in Nigeria should prioritize athlete health by developing policies that mandate regular health assessments, subsidize treatment, and support research into disease-performance links. Increased budgetary allocation to athlete health and performance programs is crucial.

8. **Research and Monitoring:** Further research should be conducted to track the long-term impact of parasitic infections on sport performance and recovery patterns among athletes. Longitudinal studies can help design more effective intervention strategies and track the effectiveness of implemented programs.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this study. All procedures followed ethical guidelines, and there were no financial, institutional, or personal interests that could have influenced the outcomes of the research.

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