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Research Article

Relationship between Tennis Sports Ability Consumption and Sports Characteristics Based on the Fusion Sensor Internet of Things

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In recent years, under the promotion of social informatization and knowledge economy, sports undertakings have accepted and introduced information technology. It has begun to move forward on the road of sports informatization. The purpose of this paper is to study the relationship between the consumption of tennis exercise ability and movement characteristics of the fusion sensor Internet of Things and introduce the related concepts of sensors and the Internet of Things, as well as the related meanings of tennis exercise ability consumption and movement characteristics. The development of real-time sports data monitoring network has become the core of informatization. It first extracts information from a large amount of data that is helpful for making scientific management decisions for athletes and then formulates scientific management decisions for sports training. Finally, the goal of improving the technical and tactical level of athletes is achieved through various intelligent equipment or manual control measures. A survey was conducted on eight boys who like tennis, and the results showed that when $r = 0.34$, the midfielder draws and blocks the ball and was weakly related to the energy in the recovery period; $r < 0.3$ midfield jump kill; total energy consumption during exercise and energy consumption in recovery period were almost irrelevant. The backcourt smash $r = 0.533$, indicating that the backcourt smash was moderately positively correlated with the energy consumption during the recovery period; the backcourt smash $r = 0.826$, indicating that the backcourt smash was highly positively correlated with the energy consumption during the recovery period.

1. Introduction

With the rapid development of radio frequency technology, embedded technology, distributed processing technology, and sensing technology, wireless sensor network technology continues to mature and has been successfully used in environmental protection, smart home, medical and health, disaster warning, agriculture, industry, military, and national defense. It plays an important role in many fields. The continuous in-depth research on wireless sensor network technology will promote the level of China's informatization construction and drive the development of related disciplines and industries. Tennis was admired by a few European and American countries in the mid-nineteenth century. In 1877, junior tennis tournaments were held in England, marking the introduction of modern tennis.

Tennis, after entering the twentieth century, has gradually become popular around the world. Tennis is respected by more and more countries and develops step by step. Tennis has been perceived, recognized, and worshiped by more people. Tennis originated in France, was introduced to the world in England, and was born in the United States. As the second largest sport on the planet, tennis has become a mode of movement on the planet. Exploring the relationship between certain physiological and psychological indicators and athletic performance or motor skills has become the basic research on tennis. If the important relationship between cognitive depth, placement accuracy, cognitive speed, and failure rate in receiving services can be found, then the value of cognitive ability in the selection of sports psychology materials can be demonstrated. It can provide theoretical basis for the psychological indicators of sports psychology material selection. It is of great significance for the promotion of perceptual ability in tennis players' sports psychology material selection. The innovation of this paper lies in the research on the relationship between tennis exercise ability consumption and exercise characteristics by fused sensor Internet of Things, which is innovative and practical.

2. Related Work

With the gradual rise of sports, more and more scholars have gradually carried out research on tennis sports ability consumption and sports characteristics. The primary objective of the Filipcic et al. study was to establish differences between selected performance measures of junior and entry-level professional tennis players in five playing situations [1]. Fitzpatrick et al. analyzed 984 singles' matches at Roland-Garros and Wimbledon in 2016 and 2017 [2]. Bastug and Sitki aimed to examine the attention, concentration, and mental toughness characteristics of tennis, table tennis, and tennis players [3]. He et al. aimed to investigate the kinematic differences of lower extremities in oblique (DS) and direct (SS) patients [4]. However, the shortcoming of these studies is that the models constructed are not scientific enough.

The sensor Internet of Things has a very broad and in-depth application in various industries, and more and more scholars have carried out research on the sensor Internet of Things. Bijarbooneh et al. proposed a multiphase adaptive sensing algorithm [5]. Abidoye and Obagbuwa proposed two energy-saving models for wireless sensor networks in the Internet of Things environment. One is a service-aware clustering model, and the other is an energy-aware clustering model [6]. Papanikolaou and Tsoulis described a framework architecture for interconnecting multiple wireless sensor networks to the Internet to realize the vision of the Internet of Things [7]. Verma and Srivastava provided an overview of the Internet of Things (IoT), focusing on implementing system security, architecture, business models, and application issues [8]. However, the studies are only on the surface of the Internet of Things and have not conducted in-depth research on its connotation and its impact.

3. Related Methods of Sensor Internet of Things

3.1. Internet of Things

3.1.1. Internet of Things' Architecture. The Internet of Things is a huge social comprehensive information system, and it is also a huge industrial interest chain that covers all aspects of today's information science and penetrates into all industries of the national economy [9, 10]. At present, the architecture of the Internet of Things recognized in the industry mainly includes three parts, as shown in Figure 1. The top layer is the application layer, the bottom layer is the perception layer, and the middle transport carrier is the network layer. The communication between the bottom layer and the top layer is completed through wired network, wireless network, and other facilities.

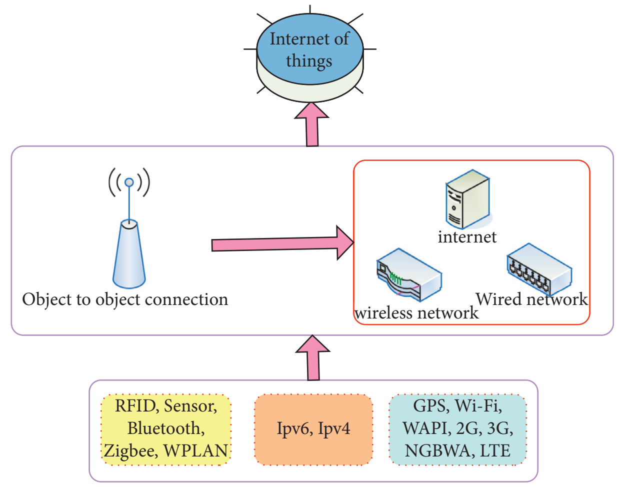

Figure 1: Internet of Things' architecture.

The basic framework of the Internet of Things has been initially established. Compared with the Internet, the Internet of Things has a wider coverage and is an expansion of the Internet. The Internet is an important part of the Internet of Things, which is mainly responsible for the transmission of information. The underlying data collection is composed of wireless sensor network, ad hoc network, radio frequency identification network, and so on. The Internet of Things is the organic integration of all existing networks to realize the communication between people and the world [11].

The biggest feature of the Internet of Things industry chain is diversification, that is, no matter the perception layer, the transmission layer, or the application layer, there is a lot of room for selection of components that implement functions at each layer. This is very different from the previous fixed and single industry chain, with only one master controller in each link. It provides more competition; thus, it is more potential. The industrial chain of the Internet of Things involves many fields, covering all aspects of the current cutting-edge information technology. With the vigorous development of industry applications, more technologies and products will be developed, with significant business opportunities [12]. At present, the Internet of Things is in the initial stage of development. The main driving force for the development of the Internet of Things will be the demand of the hardware market, but the hardware market will eventually be saturated one day. With the continuous improvement of the Internet of Things infrastructure, the demand for related applications will increase rapidly, which will be the biggest benefit of the Internet of Things. However, as far as the current situation is concerned, it is still necessary to vigorously promote the infrastructure construction of the Internet of Things.

3.1.2. Protocol Design. The SORCA topology is improved, and the SORCA-W algorithm is proposed. By adding different network nodes to summarize, judge, modify the neighbor node table, and add network names, multiple wireless sensor networks can connect and communicate [13].

(1) Calculation of the Number of Cluster Heads. For a clustered network, an application with a coverage ratio of η is required, that is, in the network, several cluster head nodes (assuming this number is H) are required for detection in each round. The ratio of the total area covered by these two cluster head nodes (the coverage is repeated once) and the total monitoring area $\|C\|$ cannot be less than η. The maximum valid range covered by a single cluster head is $(3\sqrt{3}\,X^2/2L^2)$, so it can be calculated that any point $C(a,b)$ located in area C is not clustered in the network:

$$K_u\,(1 \le u \le H). \tag{1}$$

The covered probabilities are the following:

$$P_{c-n\text{covered}} = 1 - \left(\frac{K_{u-\text{cover}}}{\|C\|}\right). \tag{2}$$

Then,

$$P_{c-n\text{covered}} = 1 - \frac{3\sqrt{3}X^2}{2L^2}. \tag{3}$$

Therefore, the probability $P_{c-n\text{covered}}$ that any point $C(a,b)$ in area C covered by at least one cluster head node in area C is the seamless coverage rate of the network (among them, H is the number of cluster head nodes in the retting area):

$$P_{c-n\text{covered}} = \eta = 1 - P^h_{c-n\text{covered}}, \tag{4}$$

$$P_{c-n\text{covered}} = 1 - \left(1 - \frac{3\sqrt{3}\,X^2}{2L^2}\right)^h. \tag{5}$$

The number of cluster heads h is

$$H = \left[\frac{\ln(1-\eta)}{\ln\left(\left(1 - 3\sqrt{3}\,X^2\right)/2L^2\right)}\right]. \tag{6}$$

(2) Cluster Head Selection. The cluster head election adopts a distributed algorithm. Each node independently judges whether it will become the cluster head by calculating the competition probability [14]. In order to make the energy of the nodes can be consumed evenly, the probability of the node u becoming the cluster head is

$$P_{u-ch} = \max\left(\frac{H}{N} \times \frac{E_{u-\text{current}}}{E_{\text{origin}}}, \frac{H}{N} \times \frac{E_{\min}}{E_{\text{origin}}}\right). \tag{7}$$

Among them, H is determined by formula (5). The function of H/N is to limit the number of initial cluster heads. E_{origin} is the initial energy of the node, $E_{u-\text{current}}$ is the current actual energy of the node, and $E_{\min}$ is the minimum energy required to compete for the cluster head node. The value of $E_{\min}$ depends on the specific application and environment. The setting of this value ensures that the cluster head will not be replaced frequently. When the node energy is less than $E_{\min}$, the node will not participate in the election of the cluster head [15]. The energy consumption model of the algorithm is the same as that of LEACH, and the energy consumption of sending and receiving messages is shown in

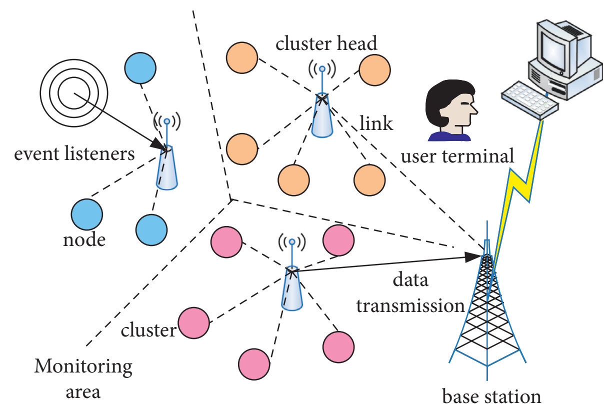

Figure 2: Typical structure of a sensor network.

$$E_{tx}(j,k) = E_{tx-\text{elec}}(j) + E_{tx-\text{amp}}(j,k). \tag{8}$$

That is,

$$E_{tx}(j,k) = \begin{cases} jE_{\text{elec}} + j\varepsilon_{fs}k^2, & k < k_0, \\ jE_{\text{elec}} + j\varepsilon_{mp}k^4, & k \ge k_0, \end{cases} \tag{9}$$

$$E_{rs}(j) = E_{rs-\text{elec}}(j) = jE_{\text{elec}}. \tag{10}$$

Among them, ε_{fs} represents the amplifier energy consumption of the multichannel attenuation model, ε_{mp} represents the energy consumption of the free space model, j is the number of data bits sent or received, E_{elec} represents the circuit energy consumption of wireless transceiver, and k_0 is a constant. Therefore, $E_{\min}$ can be obtained by

$$E_{\min} = jE_{\min}\left(\frac{N}{H-1}\right) + jE_{da}\left(\frac{N}{H}\right) + jE_{\text{elec}} + j\varepsilon_{mp}k^4_{toBS}. \tag{11}$$

Among them, the energy that needs to be consumed to aggregate the data is represented by E_{da} [16].

3.2. Wireless Sensor Networks

3.2.1. Introduction to Wireless Sensor Networks. A wireless sensor network is a self-organizing network composed of a group of microsensor nodes deployed in the monitoring area, which has various functions such as information collection, data processing, and wireless transceiver. Figure 2 is a schematic diagram of a typical structure of a sensor network [17]. By randomly distributing a large number of sensor nodes or manually deploying them in the monitoring area, real-time monitoring and collection of perceived objects are of interest to the observer (e.g.). Then, the node embedded processing system analyzes and processes the collected information. The data collected by the nodes in the

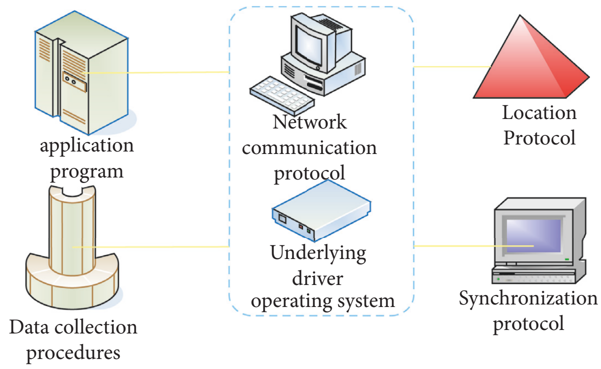

Figure 3: Wireless sensor node software structure diagram.

cluster are aggregated to the cluster head node, and after the data fusion of the cluster head node, the data are routed to the base station in the way of multihop communication. Finally, the base station transmits the data to the user terminal by wireless or wired, so as to realize the real-time monitoring of the remote target by the user.

The earliest research on wireless sensor networks can be traced back to the Cold War period, the submarine sound monitoring system started by the US military. The modern sensor network is the beginning of research by the US Defense Advanced Research Projects Agency in the late 1970s. With the continuous advancement of network communication technology, computer technology, and circuit manufacturing technology, wireless sensor networks have developed rapidly. At present, the wireless sensor network can not only acquire and comprehensively process various media information, but also its local network can realize the interconnection and intercommunication with the Internet through gateways and routers to continuously expand the network scale. Wireless sensor networks have become one of the current research hotspots in the world [18].

3.2.2. Software Structure of the Wireless Sensor Network. The sensor node is a microelectromechanical system composed of single-chip or embedded processing. Its software mainly includes the following components: operating system, underlying driver, application program, network communication protocol, data collection program, positioning, synchronization protocol, etc., as shown in Figure 3.

Among them, the network communication protocol is the most important part of the wireless sensor network software structure, which directly affects the network performance and has been a research hotspot.

3.2.3. Characteristics of Wireless Sensor Networks

(1) Network Self-Organization. Sensor nodes are generally randomly deployed in monitoring areas without infrastructure, such as nodes scattered in forests and Gobi. The location information and neighbor relationships of nodes cannot be determined in advance. Therefore, it is required that nodes must be able to automatically perform configuration management and form a multihop wireless ad hoc network capable of collecting and forwarding data through preset neighbor discovery mechanisms and network protocols [19].

(2) Limited Energy. Sensor nodes have a small size, wide distribution, low cost, and harsh working environment. The energy carried by their batteries is limited and cannot be easily replaced once deployed. The level of battery energy directly determines the life of the entire network. Under the condition that it is unrealistic to replace the node battery, it is necessary to save energy consumption as much as possible to prolong the life cycle of the network.

(3) Large Number of Nodes and Wide Distribution. In order to obtain comprehensive target information, a large number of microsensor nodes are often deployed in the monitoring area. Such dense deployment can improve the accuracy of monitoring information and reduce the network's dependence on a single node. It will not affect the normal operation of the network due to the failure of a single node. But it also brings a series of problems, such as signal conflict and information redundancy, the selection of effective information transmission paths, and the cooperative work of a large number of nodes.

(4) Network Topology Dynamics. Wireless sensor network is a dynamic network, and its topology will change continuously with the reasons of node failure and exit, movement, and discontinuous and continuous communication links. Therefore, in order to ensure the normal operation of the network, the network must be reconfigured and self-adjusting, allowing the occurrence of node failures.

(5) Low Security. Wireless sensor network uses wireless transmission and adopts distributed network structure, which is vulnerable to passive eavesdropping, active intrusion, and replay attacks. In addition, sensor nodes arranged in an open-air environment are easily captured by the enemy. The data security cannot be guaranteed. Although researchers have proposed some security defense measures for sensor networks this year, the security situation of sensor networks is still grim.

3.2.4. Adaptive Data Collection Protocol for Mobile Sensor Networks. The traditional wireless sensor network data collection algorithm is not suitable for this kind of mobile sensor network. Based on the analysis of the characteristics of mobile sensor networks and existing data collection techniques, this chapter proposed an adaptive data collection mechanism for mobile sensor networks [20].

(1) Residual Energy. The residual energy of a node is defined in a normalized form as follows:

$$E_u = \frac{E_k}{E_t}. \tag{12}$$

Among them, E_k represents the current remaining energy value of the node and E_t represents the total energy value of all nodes in the network. The residual energy of a node is closely related to the survival time of the node. The more residual energy, the longer its effective working time and the more opportunities for the node to undertake forwarding tasks.

(2) Probability of Encounter. Because the nodes in the mobile sensor network are constantly moving and are not within the communication range of the base station, it is very common, and the probability of encounter can be used to represent the possibility of the node communicating with the base station. Assuming that the initial encounter probability of all nodes is 0, when a node establishes communication with a node or a node and a base station, the encounter probability will change. The specific calculation formula is as follows:

$$\xi_u = \begin{cases} (1-\alpha)\xi_j, & u\text{encounters} j, \text{ and } \xi_j > [\xi_u], \\ [\xi_u]\beta, & \text{Timeout expired.} \end{cases} \quad (13)$$

Among them, α, β is a constant between [0, 1], α represents the weight used to save the historical probability, and β represents the time decay factor, which represents the probability of node u encountering itself before node j.

(3) Transmission Probability. The transmission probability represents the probability that each node successfully transmits information to the base station. Its calculation formula is as follows:

$$T_u = (1-\lambda)E_u + \lambda\xi_u. \quad (14)$$

Among them, λ is a constant between [0, 1], ξ_u is the probability of encountering the node and E_u is the normalized residual energy of the node. It can be seen from the above formula that more the remaining energy of the node and the greater the probability of encounter, the higher the transmission success rate.

(4) Importance. The importance of information indicates the reliability of information transmission. When each information is generated, the node will determine its initial importance according to the extensive application of the data in the information. When the information starts to be transmitted in the network, every time a copy is added, its network redundancy begins to increase, and the reliability of information transmission also increases accordingly. At this time, the importance of the information and its copies will also change. The specific calculation formula is as follows:

$$H_u^m = \frac{T_u}{1-(1-T_u)(1-T_v)} H_u^{m'}. \quad (15)$$

These formulas represent the change process of the importance of information m successfully transmitted from node u to v, among them S_u^m represents the importance of information m in node u and $S_u^{m'}$ represents the importance of message m before node u communicates with v. T_u, T_v are the transmission probabilities of nodes u and v, respectively.

The transmission condition of node occurrence information is

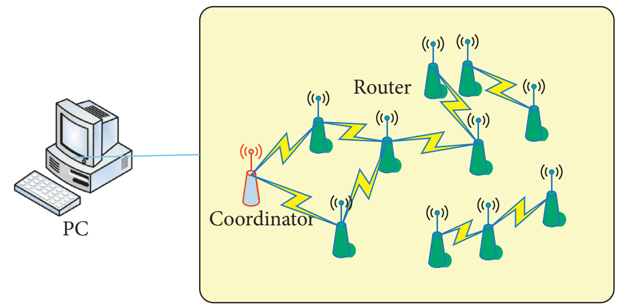

Figure 4: Structural diagram of motion detection and system.

$$T_v > T_u. \quad (16)$$

It can be seen that

$$H_u^{m'} < H_u^m. \quad (17)$$

That is, as the number of copies of information transmitted increases, the importance of the information decreases. Whenever the information is forwarded once at a node, its importance will be recalculated once, and when the importance decreases to a set threshold, the information will stop forwarding [21].

(5) Information Lifetime. The lifetime of information represents the survival time of information in the network, which can be used to measure the freshness of information. By setting a specific field in the header of each message, the lifetime of the message is stored.

3.3. Overall Design Scheme of the Human Motion Energy Consumption Detection System

3.3.1. Human Motion Energy Consumption Detection System. There are many ways to detect energy consumption, such as direct calorimetry, indirect calorimetry, heart rate detection, and self-reporting methods. Among them, the simple test method of human energy test includes gas metabolism test method, double-labeled water method, and other test methods. The human body movement energy consumption detection equipment is used for the sunlight movement detection project of the students of primary and middle schools. Human movement is a multivariable including frequency, intensity, type of movement, duration of movement, and individual differences [22]. This system consists of two parts: the detection terminal and the upper computer processing platform. The detection terminal includes a coordinator and several router nodes. The upper computer processing platform is realized by a PC running the monitoring system, forming a set of convenient and high-precision human motion energy consumption detection system. The structural block diagram of the entire human motion energy consumption detection system is shown in Figure 4.

3.3.2. Selection of Network Topology of Human Motion Energy Consumption Detection System. The ZigBee network can realize three network topologies of star, tree, and mesh.

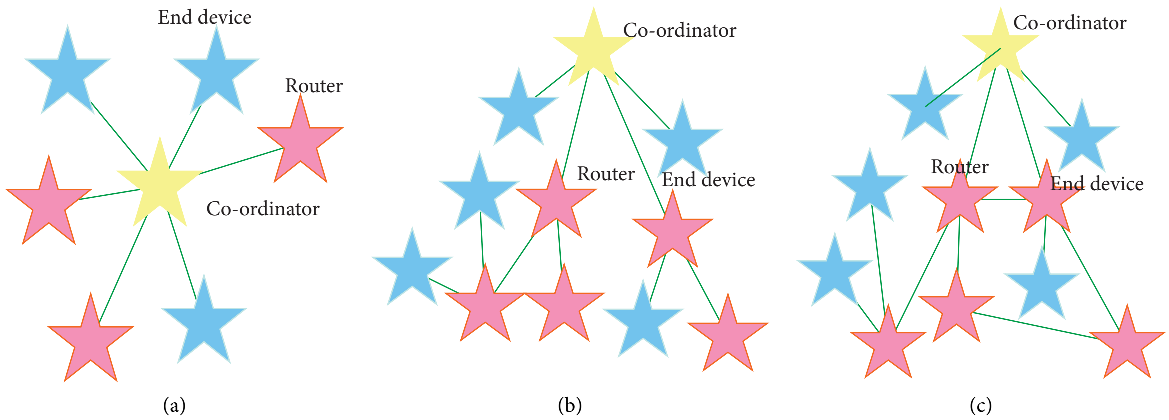

Figure 5: Network topology form (a) star, (b) tree shape, and (c) mesh.

Table 1: Basic data of subjects ($n = 8$).

Name	Age (years)	Height (CM)	Weight (kg)	Years of exercise	BMI
A	23	176	73	2	23.6
B	22	182	71	2	21.4
C	21	172	65	1	22.0
D	20	180	73	1	22.5
E	24	176	75	3	24.2
F	20	171	62	1	21.2
G	24	174	73	4	24.1
H	23	175	66	3	21.6
$\overline{X} \pm SD$	22 ± 1.46	176 ± 3.94	70 ± 5.72	2 ± 1.06	22.6 ± 1.73

The schematic diagram of the three topologies is shown in Figure 5.

The star topology is the simplest form of topology. When the wireless sensor network is widely distributed, the tree topology is a suitable form. Mesh topology (mesh topology) has the same form as tree topology and has powerful functions. When possible, the routers can communicate directly and can also communicate through "multilevel hops," which have more flexible information routing rules. Mesh network topology also has self-organization and self-healing functions, which make the exchange of information become more efficient.

4. Experiment on the Relationship between Tennis Exercise Ability Consumption and Exercise Characteristics

4.1. Objects and Methods. The subjects of the study are eight boys (A, B, C, D, E, F, G, and H) who like tennis. They have similar levels of tennis skills, are familiar with the rules of the game, and are proficient in applying various tennis skills. The boys were divided into groups, two in each group, one of them wears an instrument in the test area to play the game, and the other person is in the other half of the field as a companion. The two sides will compete according to the best-of-five-three system, obey the referee's ruling, and then proceed to pick sides, start the game, serve, and catch the ball. The experiment was completed until 8 subjects were tested. The basic conditions of the research subjects are shown in Table 1:

The calculation and statistics of energy consumption in tennis are based on the metabolism of air during the test application process, and the specific energy value during a single air exchange process can be obtained. The unit is kcal/d. The overall detection process is 60 seconds of quiet conditions. After exercising, and then recovering, the energy consumption of the overall process of air exchange can be obtained by using the equipment. Calculating the energy metabolism rate per second in different periods requires kcal/86400 (the energy consumption value per second is calculated by dividing the energy consumption value per day by the number of seconds per day). The energy consumption per second is multiplied by the recording time to obtain the energy consumption of this time period. Through this method, the Excel tool software can be used to calculate the energy consumption in the quiet state, the energy consumption in the exercise state, and the energy consumption in the recovery phase.

4.2. Various Indicators in the Process of Tennis Competition

4.2.1. Metabolism of Heart Rate Index during Tennis Competition. The use of maximum heart rate to determine exercise intensity is commonly used in sports. When playing tennis, the mean heart rate is the most basic physiological factor for evaluating the burden of the game. Figure 6 is a graph of the monitored heart rate changes of eight athletes before, during, and after a tennis match.

According to the test results (Table 2), among the eight subjects, the resting heart rates of A, B, C, and E were more than 70 beats/min and F and H were less than 70 beats/min.

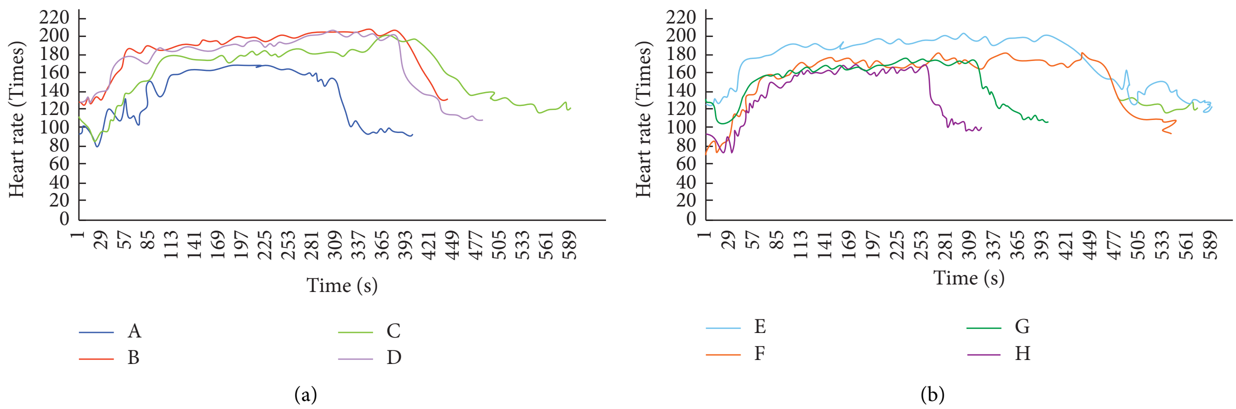

Figure 6: Heart rate graphs before, during, and after a tennis match.

Table 2: Central rate value (times) during tennis competition.

$N = 8$	Maximum	Minimum value	Quiet	Average value
A	175	99	70	155.77
B	209	122	75	191.98
C	197	106	73	175.44
D	209	120	76	186.32
E	200	138	78	190.77
F	181	100	69	166.88
G	172	132	71	162.78
H	168	94	62	153.44
$\overline{X} \pm$ SD	189 ± 16.53	114 ± 16.15	72 ± 5.05	172.99 ± 15.54

In a resting state, the normal heart rate of adults was 60-100 beats per minute. The heart rate of athletes is slower than that of ordinary adults. It can be seen from Table 2 that A, H, F, and G have relatively high training levels. Compared with other players, they have better control over themselves during the competition. They can control the progress of the game, better coordinate their breathing during exercise, and can use more reasonable related movements and moving footwork. According to the survey, A, G, F, and G often play ball and exercise in foreign substitutes, while others rarely participate in high-intensity sports. Therefore, the resting heart rate is relatively high, and it can also be inferred that A, G, F, and G have strong recovery ability during the recovery period. It can be found from Figure 6 that when exercising, the heart rate of all testers will increase rapidly, and the heart rate during exercise is highly correlated with the distance of footsteps during exercise and the intensity of the competition. The average maximum heart rate of the tennis public fitness crowd is 189 beats/min during exercise, the average minimum heart rate is 114 beats/min, and the average heart rate at rest is 72 beats/min.

4.2.2. Energy Consumption Characteristics during Tennis Matches. The energy expenditure of the subjects increased continuously as the tennis match started and decreased when the game ended (Figure 7). The relative energy consumption kcal/d is obtained from the experimental data, the energy consumption rate per second (j/s) is calculated according to the formula, the time recorded intermittently by the telemeter of each subject is sorted out, and the energy consumption per second in different time periods is used. The energy consumption of each recording was calculated by multiplying the rate by the time spent in this period, resulting in the total energy consumption of the entire experiment (Table 3).

Total net energy consumption of exercise = (energy consumption during exercise − quiet energy consumption) + (energy consumption during recovery period − quiet energy consumption). According to the conversion rate of 1 kcal = 4.187 KJ, it is calculated that the average total energy consumption of tennis fitness players is 460.01 KJ, the average energy consumption of the recovery period is 103.94 KJ, and the total net energy consumption of a tennis singles exercise for the general fitness group is 522.63 KJ.

4.3. Basic Hitting Techniques and Energy Consumption during Tennis Matches

4.3.1. Statistics of Basic Hitting Skills during Tennis Matches. In tennis competitions, due to different personal athletic abilities, techniques, and tactics, the direction and speed of the incoming ball during the game are different, which determine the different hitting techniques during the game. The batting techniques in tennis are generally divided into front court techniques, midfield techniques, and backcourt techniques. The front court batting techniques mainly

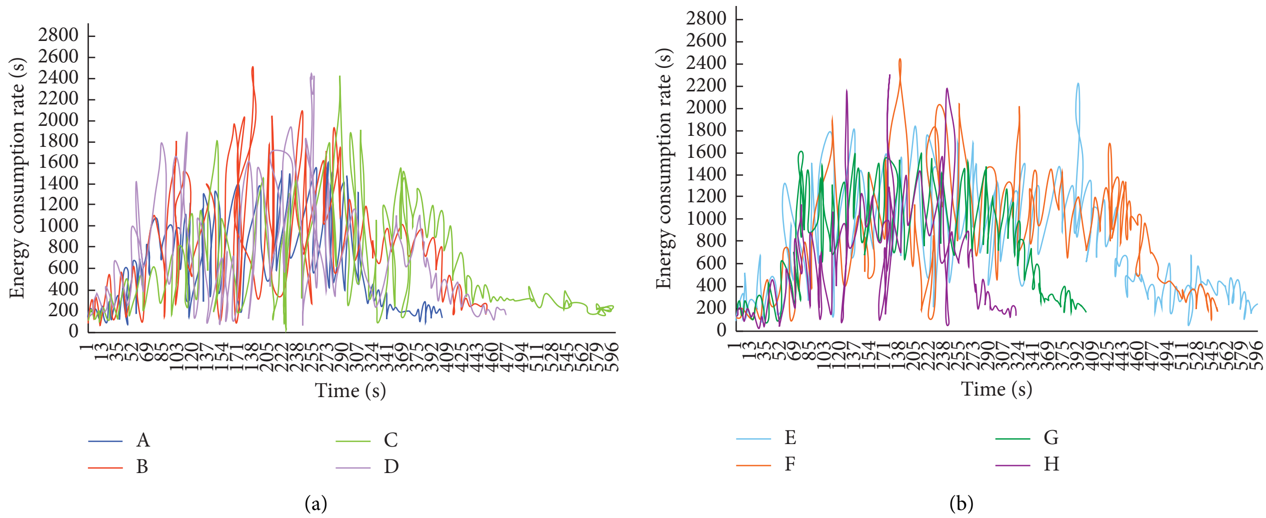

Figure 7: Energy consumption rate at different times during the experiment.

Table 3: Energy consumption table during the experiment.

$N = 8$	Quiet energy consumption (kJ)	Energy consumption during exercise (kJ)	Energy consumption in recovery period (kJ)	Total net energy consumption of sports (kJ)
A	30.53	365.39	109.99	414.23
B	13.92	489.99	79.6	542.44
C	16.16	437.65	130.33	535.66
D	19.31	435.66	122.53	519.41
E	23.59	543.01	157.61	652.42
F	18.59	562.31	72.41	597.36
G	21.88	457.88	83.51	497.66
H	21.15	389.91	76.77	423.21
$\overline{X} \pm$ SD	20.69 ± 5.11	460.11 ± 69.03	103.96 ± 30.69	522.62 ± 80.39

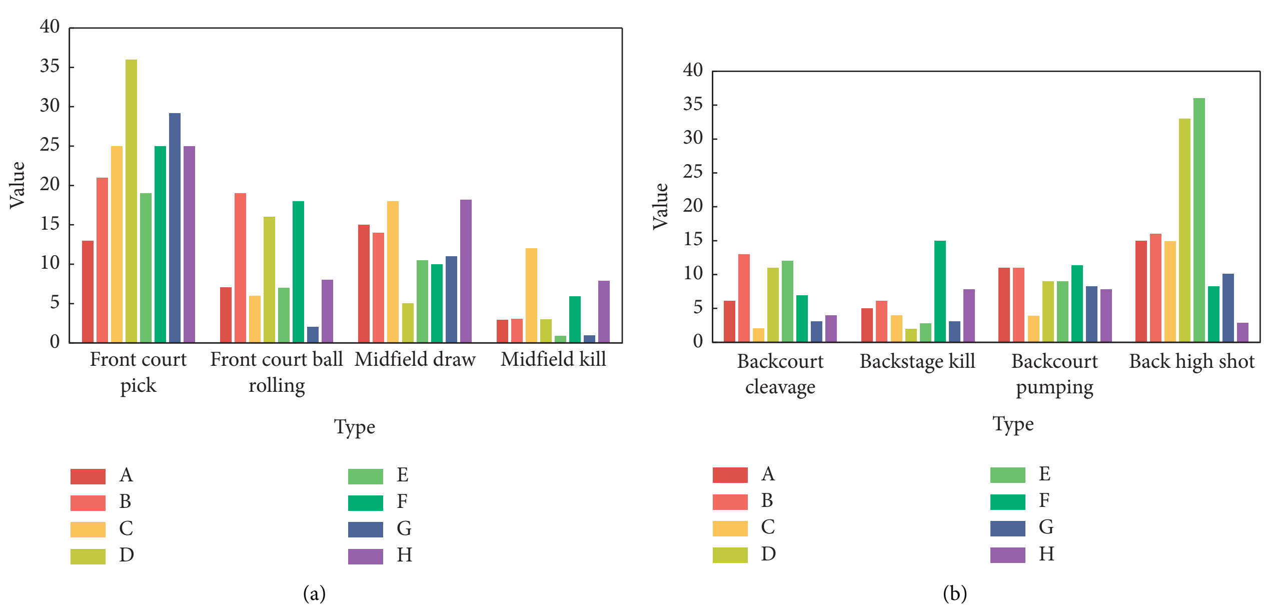

Figure 8: Batting skill statistics (times).

Table 4: Correlation coefficient between hitting technique and energy consumption in sports.

Two variables	Pearson correlation R value
Front court pickup and energy consumption	0.016
Front court ball rolling and sports energy consumption	0.416
Front court flat draw and block and sports energy consumption	-0.366
Jumping and killing in the front court and sports energy consumption	-0.282
Back field splitting and lifting and energy consumption	0.54
Backcourt smash and sports energy consumption	0.490
Backcourt pitching and sports energy consumption	0.431
Back high ball and energy consumption	0.233

Table 5: Correlation coefficient between hitting technique and energy consumption during recovery period.

Two variables	Pearson correlation R value
Energy consumption of front court pickup and recovery period	−0.112
Front court ball rolling and energy consumption in recovery period	−0.311
Energy consumption during recovery period	−0.33
Jump and kill in midfield energy consumption in recovery period	0.29
Energy consumption in the recovery period	0.341
Energy consumption in the recovery period	0.529
Energy consumption in backcourt draw recovery period	−0.130
Energy consumption during recovery period	0.825*
Exercise energy consumption and energy consumption in recovery period	0.052

include rubbing and releasing the ball, pushing the ball, throwing the ball, picking the ball, releasing the ball, and hooking the ball. The midfield batting techniques mainly include pitching, drawing, smashing, picking, and intercepting the ball. The backcourt batting techniques include heavy smashing technique, lob technique, loft technique, pitch technique, low lob technique, and swipe technique. This paper selected several techniques mostly used by mass fitness practitioners in tennis games for statistics and analyzed the correlation coefficient between them and energy consumption during exercise. As shown in Figure 8, the skill level of each of the eight subjects is different, and the opponent's level is different, so the basic skills of hitting the ball are also different. The average bodybuilder picks the ball 23 times/inning in the front court in a tennis match, rubs the ball 10 times/inning in the front court, draws 12 times/inning in the middle, smashes the ball 4 times/inning in the middle, smashes the ball 7 times/inning in the backcourt, smashes the ball 6 times/inning in the backcourt, draws the ball in the backcourt 9 times/inning, and 17 times/inning with high ball in the backcourt. From the statistical data, it can be seen that the general fitness people have a good grasp of the basic skills in tennis, but the application of some difficult techniques is significantly lower. In tennis, there are many passive situations, which are related to the movement of footsteps and the speed of returning to the center position.

4.3.2. Correlation Coefficient between Energy Consumption Characteristics and Basic Hitting Skills during Tennis Matches. From the data in Table 4, it can be seen that the midfield leveling and blocking and midfield jumping and killing techniques are negatively correlated with energy consumption, and the front court rubbing the ball, the back court smashing the ball, the back court smashing the ball, and the back court smashing the ball are moderately related to energy metabolism in sports. The correlation coefficients are in the order of rubbing the ball in the front court > pitching and hanging in the backcourt > smashing the ball in the backcourt > pumping the ball in the backcourt. The number of hits on the back ball is not correlated with energy expenditure during exercise.

As shown in Table 5, there is a negative correlation between the midfield leveling block and the recovery period energy. $r = 0.34$ means that the midfield leveling block is weakly related to the energy in the recovery period. That is, the more the midfield leveling block is applied, the smaller the energy consumption in the recovery period. Because $r < 0.3$, the two variables are almost irrelevant. The backcourt smash is $r = 0.533$, and it has a moderate positive correlation with the energy consumption during the recovery period. That is, the more the backcourt smash technique is applied, the greater the energy consumption during the recovery period. The backcourt smash is $r = 0.826$. It shows that the backcourt high ball is highly positively correlated with the energy consumption in the recovery period. That is, the more the backcourt high ball is used in the game technique, the greater the total energy consumption in the recovery period.

5. Conclusion

In the competitive sports arena, athletes' sports skills and physical fitness tend to be flat. If athletes want to be invincible, they can only improve their psychological quality. On the one hand, the acquisition of these abilities is caused by congenital genetic factors, and on the other hand, it is obtained by the acquired special effort training: (1) the most widely used movement direction in tennis is backward movement, and the left backward movement is significantly related to exercise energy consumption. (2) In the national fitness movement of tennis, the application of front court technology is the most common, and the backcourt segmentation technology has a great relationship with sports energy consumption. Back ball height is associated with high energy expenditure during recovery. (3) In tennis, high-speed backward movement is related to energy consumption. The sports field after low speed is significantly correlated with energy expenditure during the recovery phase.

Data Availability

The raw data for this manuscript can be obtained upon request to the corresponding author.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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