Groundwater vulnerability based on bee colony optimization and real-time monitoring of exercise weight loss effect

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Abstract
In fact, the groundwater pollution caused by the acceleration of industrialization and rapid population growth is an important constraint to sustainable development. Taking L area as an example, this paper finds out the differences of groundwater vulnerability in this area and plans the groundwater vulnerability classification. For China’s groundwater protection work, it is very important for the management departments at all levels in each L area to provide development technology support for enterprises. Based on the concept of groundwater quality vulnerability and groundwater vulnerability assessment method in Japan, according to the actual situation of the study area, this paper analyzes the vulnerability of natural geography, meteorology and hydrology, geological conditions, and human activities in the area. This paper establishes an optimized and improved DRASTIC model and adds the evaluation factors affecting human activities into the evaluation conditions of traditional DRASTIC model, that is, the current land use status and groundwater exploitation. By combining bee colony optimization with groundwater vulnerability assessment model, groundwater vulnerability assessment is carried out. This paper also uses the special computer system to simulate the decision-making process of medical staff, provides obesity intelligence diagnosis and personalized prescription exercise, carries out exercise weight loss monitoring for obese teenagers, helps teenagers to achieve healthy exercise and diet, and provides scientific guidance for fitness guidance of Chinese diet youth. The system adopts the methods of artificial intelligence and software development, diagnoses obesity through youth physique test, provides personalized exercise prescription through special system, monitors diet work in real time, and provides timely feedback. In this paper, the vulnerability of groundwater quality and exercise weight loss effect of real-time monitoring are studied and applied to bee colony optimization to promote its development.

Keywords  Colony optimization · Groundwater · Water quality vulnerability · Exercise weight loss monitoring

Introduction
L is an island county, which is short of water resources. Although the groundwater resources in the island are relatively rich, they are underutilized. The development and utilization of groundwater resources are important means to solve the shortage of water resources. Therefore, groundwater quality vulnerability assessment is an important tool to protect groundwater resources and prevent groundwater pollution. Therefore, it is of great significance to the assessment of groundwater vulnerability in the island. As a part of this work, we collected the hydraulic engineering, geographic information, and social data of L island. According to the model of L area, we used ArcGIS software and battery index method to evaluate the vulnerability of groundwater quality in the specific environment of L island (Pan et al. 2013), mainly using ArcGIS software. Du’s model is to evaluate the vulnerability of groundwater to L island waters. In order to avoid subjective effects, this paper uses AHP and operator sentiment monitoring, replacing the weight and score indicators. According to the evaluation, the widest distribution area is the lowest vulnerability, about 135.87 km², accounting for 48.68%, and the lowest vulnerability distribution area is the smallest, 14.29 km², accounting for 5.12%. High vulnerability areas are mainly distributed in Wensu plain, with a total area of 35.37 km².
accounting for 12.67% of the land area (Rutqvist 2012); about 54.81 km² of highly vulnerable areas, accounting for 19.64%.

Because DRASTIC model cannot fully express the actual situation of L archipelago, we adjusted and modified some indicators on this basis and constructed drasli Ke system to assess water quality vulnerability (Pruess et al. 2004). Finally, we established groundwater vulnerability zoning map through bee colony optimization and finally established groundwater vulnerability zoning map through bee colony optimization (Pini et al. 2010). It was found that the least high-risk areas were mainly distributed in plain areas, with a total area of 53.93 km², accounting for 19.32% of the land area (Qaroush et al. 2018); the highly vulnerable area is about 42.84 km², accounting for 15.35%. Finally, the evaluation results of drastic system and drasli Ke system are compared and analyzed. Although the distribution characteristics of these two kinds of water quality vulnerability are consistent, there are some differences in distribution and area. And we also use computer programs to simulate the thinking process of medical staff, design, and develop a “youth personalized diet, the provisions of a special system based on performance monitoring,” to provide obese adolescents with obesity diagnosis, diet motivation, personalized recipes, performance monitoring, and quantitative feedback services, as well as exercise weight loss monitoring. It aims to strengthen the physical condition of contemporary young people and realize the modern planning of national health (Pan et al. 2018).

Materials and methods

Overview of the study area

In this paper, the research area is selected as a rectangular area with a length of 16 km and a width of 10 km centered on L County. The high yield forest along the M river is well known in the world. The domestic transportation is convenient, which promotes the exchange between the domestic and the foreign countries and the development of economic and cultural (Rutqvist and Tsang 2002). There are a lot of natural resources such as coal, quartz sand, and limestone, which provide resources to local economic development. The study area is mostly mountainous area, which is distributed in basin shape, surrounded by mountains on all sides, and the plain area is very rare. Therefore, we use mountainous area as the main topography of the research area, with an area of about 11.94 km²; the plain area is much smaller, with an area of about 3.7 km², and the rest of the area is river and other topography (Sayyafzadeh et al. 2015). The main river in the study area is h River, which is mainly flowing from the central region to the south and is widely distributed in the research area (Szima and Cormos 2018).

Research methods

Colony optimization

The search range of traditional algorithm is not controllable. This will make the algorithm time complexity higher; convergence speed is slow. In view of this, in order to make the algorithm locate in the target area better and not affect the randomness of the original adaptive factor [1, 1] this paper proposes the search factor $u$ based on the original adaptive factor and sets the adjustment formula of search factor as follows:

$$u = e^{-k \cdot f_{it} }$$  \hspace{1cm} (1)

$f_{it}$ is to guide the fitness of honey source after the last iteration, $K$ is an adjustable random number, and the exponential function can guarantee to expand the search scope in the early stage of the search. After the introduction of the search factor $u$, the formula leading bees to update the honey source location is as follows:

$$V_{id} = X_{id} + u \cdot \varphi \cdot (X_{id} - X_{jd})$$  \hspace{1cm} (2)

It can be seen from formula (2) that the search range of the algorithm depends on the fitness of the honey source. Setting different and corresponding search range in different periods, and the search range gradually decreases with the increase of fitness, can improve the optimization efficiency of the algorithm. In the early stage of iteration, if the fitness of honey source is small, the search scope is expanded and the probability of finding the optimal solution is increased. During the follow bee search period, the fitness of the honey source is larger and the distance from the local optimal solution is smaller, so the search range is reduced at this time, and we increase the follow bee search rate to find the optimal solution (Wang et al. 2011).

Groundwater evaluation model

According to the different types of groundwater (phreatic water, confined water), the groundwater depth refers to the distance from the surface to the groundwater level or water resisting roof. During the process of water recharge from surface to groundwater, the pollutants in the water body will be adsorbed, diluted, neutralized, or oxidized with the vadose zone medium. Therefore, the greater the groundwater depth is, the longer the pollutant migration distance is, the better the interaction effect with surrounding rock mass is, the lower the pollutant concentration is, the lower the vulnerability of groundwater is, and the stronger the reaction force is. On the contrary, the smaller the groundwater depth is, the higher the pollutant concentration is, and the greater the possibility of groundwater contamination is (Weniger et al. 2012). The
higher the vulnerability, the worse the antifouling performance.

The net replenishment of the hydrolytic layer is the amount of water per unit area that infiltrates and replenishes groundwater from the earth’s surface and reaches the hydrolytic layer. When water infiltrates from the earth’s surface and passes through the crust, it will cause gonorrhea and enter the groundwater together with the polluted crust surface. The amount of supply mainly depends on the rock properties, soil types, topography, vegetation, weather, and other factors in the temperate zone. Therefore, a parameter representing the traffic capacity of the area is input, which is called rainfall permeability coefficient. The reason is that the main source of net supply is precipitation (Wong et al. 2007). Therefore, the net replenishment of hydrolytic layer is usually calculated by using the dryness and permeability coefficient of regional precipitation. There are two types of impacts of net recharge on the vulnerability of groundwater: one is when the water body infiltrates from the surface, the other is when the contaminated material filters the earth’s surface, and the crust enters the hydrolysis layer to pollute the groundwater. It has a certain dilution effect on pollutants in water, thus reducing the risk of groundwater pollution. Through years of practice, it is concluded that the dilution effect of clean charging is far lower than that of introducing pollutants into groundwater when assessing the vulnerability of inflow or burst water. Therefore, the dilution effect of clean charging can be ignored. The greater the dilution effect of clean charging, the greater the transport of pollutants, the lower the vulnerability and antifouling performance of groundwater; on the contrary, the lower the vulnerability is, the stronger the antifouling performance is.

Aquifer medium is closely related to the anti-pollution ability of aquifer. Media types directly affect the process of penetration and exposure of contaminated materials. The more particles in the medium, the more developed the cracks, the smaller the contact area between the contaminated material and the hydrophilic layer, the lower the damping capacity of the contaminated material, the higher the vulnerability of groundwater, the worse the antifreeze, and the stronger the antifouling performance (Zhang and Ranjith 2019).

The different types of soil also affect the migration of pollutants. The sorting of soil particles directly affects the permeability of water body. For example, the structure of sand is rough, the permeability is good, the pollutants are easy to migrate with water flow, and the vulnerability of groundwater is high; such as silt or clay, the particles are small and dense.

Terrain slope is the main factor affecting surface runoff. The higher the gradient is, the more likely it is to cause surface runoff, which will reduce the infiltration of surface water containing pollutants and lower the vulnerability of groundwater; on the contrary, the smaller the slope is, the greater the surface water infiltration is, and the higher the groundwater vulnerability is.

The medium in seepage zone is the channel and way for pollutants to enter groundwater. When the pollutants pass through, there are many problems, such as biodegradation, neutralization, adsorption, and physicochemical reaction. The smaller the medium particle is, the worse the permeability is, the stronger the potential adsorption is, the faster the pollution attenuation is, the lower the concentration is, the lower the vulnerability of groundwater is, and the stronger the antifoul ability is.

Hydraulic conductivity is one of the factors that determine the velocity of groundwater. The more pores and cracks in the hydrolysis layer, the more regular the shape of particles, the more uniform the distribution of particles, the greater the hydraulic conductivity, the better the permeability, the more conducive to the migration of pollutants, and the higher the vulnerability of groundwater is, the contrary, it is lower.

The score of index layer is 10, which indicates that the higher the evaluation value is, the higher the groundwater vulnerability is, and the lower the ice resistance ability is; the lower the score is, the lower the vulnerability is and the higher the ability to resist halo is. The evaluation of each evaluation index is determined according to the actual situation of the study area, referring to the existing scoring system (as shown in Table 1).

Evaluation index weight

There are many methods to calculate the weight of vulnerability evaluation index. Analytic hierarchy process (AHP) was first proposed by American scientists and then introduced into China. This method can combine a series of conditions qualitatively and quantitatively and get hierarchical and data-based results. It is very practical and widely used in urban planning, economic management, and other fields.

The operation steps of AHP are mainly divided into the following steps:

1. Determining the number of model indicators will determine the event of each index analysis clearly do not miss more.

2. The judgment matrix composed of each index is established (as shown in Table 2).

The relative importance scale $A_{ij}$ of each index is determined. That is, $A_{ij}$ represents the importance of $A_i$ over $A_j$. See Table 3 for specific determination criteria. And $A_{ij} > 0$, $A_{ii} = 1/A_{jj}$, the diagonal of the matrix is 1, that is, the same index is equally important compared with itself.

3. According to the determined judgment matrix, the maximum eigenvalue and eigenvector of the matrix
are calculated by using the linear algebra calculation method, and the eigenvector is the weight.

(4) The consistency test is carried out. If the test is true, the calculation result is reasonable. The formula is as follows:

\[ CI = \frac{\lambda_{\text{max}} - n}{n - 1} \]

\[ CR = \frac{CI}{RI} \]

According to the general situation of the research area and the comprehensive analysis of the selected indicators, the importance of indicators is terrain \( T \), agricultural pollution source \( AP \), industrial pollution source \( IP \), and groundwater exploitation fraction \( G \) from small to large (as shown in Table 4).

According to the matrix calculation, the corresponding eigenvectors of the maximum eigenvalues are 0.06, 0.04, 0.02, 0.11, 0.03, 0.24, 0.17, and 0.33. \( Cr = 0.04 < 0.1 \), and the size relationship of the calculation results is in line with the given mutual importance relationship of the indicators.

**Groundwater vulnerability assessment**

After scoring according to the parameters selected by the model, the formula (5) is applied to calculate, and the

| Table 1 | Index scoring table |
|---------|---------------------|
| Evaluating indicator | Index score |
| \( D (m) \) | \( 2006-05-04 \) | \( 2006-05-04 \) |
| \( R (mm) \) | \( 2006-05-04 \) | \( 2006-05-04 \) |
| \( T (\%) \) | \( 2006-05-04 \) | \( 2006-05-04 \) |
| \( I \) | \( 2006-05-04 \) | \( 2006-05-04 \) |
| \( C (\text{mmol/L}) \) | \( 2006-05-04 \) | \( 2006-05-04 \) |
| \( IP (\text{kg/hm}^2) \) | \( 2006-05-04 \) | \( 2006-05-04 \) |
| \( G \) | \( 2006-05-04 \) | \( 2006-05-04 \) |

| Table 2 | Index judgment matrix table |
|---------|-----------------------------|
| Evaluating indicator | \( D \) | \( R \) | \( T \) | \( I \) | \( C \) | \( IP \) | \( AP \) | \( G \) |
| \( D \) | \( A_{11} \) | \( A_{12} \) | \( A_{13} \) | \( A_{14} \) | \( A_{15} \) | \( A_{16} \) | \( A_{17} \) | \( A_{18} \) |
| \( R \) | \( A_{21} \) | \( A_{22} \) | \( A_{23} \) | \( A_{24} \) | \( A_{25} \) | \( A_{26} \) | \( A_{27} \) | \( A_{28} \) |
| \( T \) | \( A_{31} \) | \( A_{32} \) | \( A_{33} \) | \( A_{34} \) | \( A_{35} \) | \( A_{36} \) | \( A_{37} \) | \( A_{38} \) |
| \( I \) | \( A_{41} \) | \( A_{42} \) | \( A_{43} \) | \( A_{44} \) | \( A_{45} \) | \( A_{46} \) | \( A_{47} \) | \( A_{48} \) |
| \( C \) | \( A_{51} \) | \( A_{52} \) | \( A_{53} \) | \( A_{54} \) | \( A_{55} \) | \( A_{56} \) | \( A_{57} \) | \( A_{58} \) |
| \( IP \) | \( A_{61} \) | \( A_{62} \) | \( A_{63} \) | \( A_{64} \) | \( A_{65} \) | \( A_{66} \) | \( A_{67} \) | \( A_{68} \) |
| \( AP \) | \( A_{71} \) | \( A_{72} \) | \( A_{73} \) | \( A_{74} \) | \( A_{75} \) | \( A_{76} \) | \( A_{77} \) | \( A_{78} \) |
| \( G \) | \( A_{81} \) | \( A_{82} \) | \( A_{83} \) | \( A_{84} \) | \( A_{85} \) | \( A_{86} \) | \( A_{87} \) | \( A_{88} \) |

| Table 3 | Scale table of important relationship of indicators |
|---------|-----------------------------------------------------|
| Scale | Importance |
| 1 | \( i \) is as important as \( j \) |
| 3 | \( i \) is slightly more important than \( j \) |
| 5 | \( i \) is obviously more important than \( j \) |
| 7 | \( i \) is more important than \( j \) |
| 9 | \( i \) is extremely important than \( j \) |
| 2, 4, 6, 8 | The median value of each importance |
groundwater vulnerability comprehensive score (DI) is obtained:

\[ DI = \sum_{i=1}^{5} (W_i \cdot R_i) \]  

where \( W_i \) is the index weight and \( R_i \) is the index score. The greater the DI value, the higher the vulnerability and the worse the anti-pollution ability of groundwater.

Therefore, the vulnerability evaluation index of the study area is as follows:

\[ DI = 0.06 \times D + 0.04 \times R + 0.02 \times T + 0.11 \times I + 0.03 \times C + 0.24 \times IP + 0.17 \times AP + 0.33 \times G \]  

**Experimental design**

The system designates professionals to unify a computer program, which simulates health professionals to solve the problem of adolescent obesity, contains many professional level exercise knowledge and experience, and can use the knowledge and ability of health professionals to solve the problem of adolescent exercise nutrition. The performance level of expert system depends on the size and strength of the activated database, as well as the facility to solve problems and the development of technology. This is why there is no permanent rule in expert system. The problem-based expert system includes knowledge base, evaluator, database, human interface, information acquisition, and logical connection among various parts of expert system.

The human-computer interaction interface is a dialog interface for information exchange between human and computer. The human-computer interaction interface converts the user input information into the standard view format of the system and sends it to the corresponding module for processing. The internal information output of the system is converted into a convenient format through the system interface. Knowledge base is a very important part of expert system. The richness of data directly affects the quality of expert system. The main function of the knowledge base is to accumulate and manage the knowledge of the expert system. The knowledge obtained from the knowledge base of the system is derived from clinical experience and specialized authoritative documents. Evaluator is the engine “reflection solution” component specified by expert system. Its main task is to use knowledge and rules to simulate the actual thinking process of experts in this field and solve problems according to the fact of adolescent obesity in decision-making. Database is the place to store data, including user personal information, diagnosis information, processing information, and result information. The system will write and call the database data from time to time. Knowledge acquisition is the acquisition of a special system, which transforms the real-time knowledge of motor rehabilitation and expert clinical experience knowledge into a form that can be used by the computer and put into the knowledge base, and is responsible for adding, modifying, and deleting the knowledge base.

After registration, the user can input the known facts through the human-computer interface and answer the questions submitted by the expert system. The system will automatically judge whether we are obese or not and the degree of obesity according to the diagnostic criteria of youth obesity. The output results are stored in a comprehensive database, and the output results and various knowledge and rules used for the purpose are presented to users through the translator. That is to provide recipes and food plans for sports. After the end of the exercise cycle, the special system collects the vital sign information of obese teenagers again, provides feedback on the influence of diet, returns to the obesity diagnosis part for diagnosis, and repeats the previous process until the end of the weight loss exercise.

**Research objects and methods of the spatial distribution of sports public service resources**

By referring to the information available at home and abroad, domestic survey information on public sports service resources, and the indicators of the circulation system of public sports service resources, the public sports service system was initially set at 8 target levels, 18 benchmark levels, and index levels 46 indicators. Regarding sports scholars and managers in a certain province, two questionnaire surveys were conducted, and a total of 30 questionnaires were retrieved. Twenty-eight valid questionnaires were obtained, with an efficiency rate of 93%. The structure and content of the questionnaires were checked for validity, and SPSS13 was finally used. 0 use the EXCEL2003 evaluation system to construct an evaluation system.
Results

Evaluation results of groundwater vulnerability model

In ArcGIS, we rasterize the score maps of the eight indicators obtained before and multiply the grid files with their corresponding weights according to formula (4). Finally, we can get the vulnerability analysis pattern. According to the calculation results, the minimum vulnerability evaluation index of the study area is 1.61, and the maximum is 5.27. By using the automatic classification method in ArcGIS, we can divide it into five grades, which are lower, lower, medium, higher, and higher in order of priority (as shown in Fig. 1).

In this paper, based on the traditional DRASTIC model, the improved dtic-iag evaluation model is obtained. In order to better illustrate the suitability of dtic-iag evaluation model for the study area, the evaluation result chart of DRASTIC model (Fig. 2) is also made, and the comparison between dtic-iag evaluation model and traditional DRASTIC model is analyzed.

(1) Similarity: the areas with low vulnerability and lower vulnerability in the study area are similar and larger, which are located in the central plain. The vulnerability results of M river channel are relatively higher. The evaluation results show that the vulnerability of this part is greatly affected by the characteristics of aquifer itself.

(2) Difference: the results of the improved method reflect the impact of industrial activities, agricultural activities, and mining conditions, and the impact location is mostly in the low and low vulnerability areas of the results of the traditional method. Therefore, if the evaluation method is not improved, the impact of this factor will be ignored, so that the evaluation results are on the contrary, which may lead to the omission of more protected areas when taking corresponding measures. The results of the two methods are also different. The results of the traditional method are higher vulnerability, which is mainly affected by the shallow buried depth of the groundwater level in the mountain area. The improved evaluation result is medium vulnerability, which is mainly because the factors will increase, which is easy to lead to the gradual decline...
of the weight. In most areas of the study area, the groundwater depth is shallow, and the development and utilization of groundwater is relatively reasonable, so it is more reasonable to reduce the impact of groundwater depth, and the results of the improved method are more accurate.

In conclusion, through the comparative analysis of the two methods, there are many similarities between the results of drtic-iag model and the results of traditional methods, which shows that the improved method is reasonable to some extent. The difference is reflected in the addition of human factors as the evaluation factor in the method. Groundwater is the main water source for people’s life, so the addition of human factors is objective and reasonable, However, the effect of human factors is far greater than that of natural factors. The evolution of hydrogeological environment is slow, and human factors are affected by many factors, such as the change of people’s water demand, enterprise relocation, enterprise transformation, and land use types. Therefore, when comparing the importance of human factors, the paper emphasizes the importance of human factors, in which the groundwater exploitation fraction is the largest influencing factor, followed by industrial pollution and agricultural pollution. Therefore, drtic-iag model can highlight the characteristic factors affecting groundwater in the study area, and the evaluation results are reasonable, which can also provide support for groundwater protection. The original drastic assessment method is a traditional vulnerability assessment method, which is also the basis of vulnerability assessment. It is not just a method, it is an idea. Drastic evaluation model is an evaluation method that summarizes the main factors that affect the groundwater environment, gives weight, and superimposes the results. However, when applied in different research areas, the main factors affecting the groundwater environment are not the same, so we should combine the actual geological and hydrogeological conditions to analyze the main factors most objectively.

**Groundwater vulnerability protection simulation results**

According to the recharge and discharge conditions, there are many recharge and discharge modes in the simulation area (as shown in Fig. 3).
The annual rainfall is distributed according to the monthly rainfall, and the different rainfall supply intensity in different months is obtained (as shown in Fig. 4). The intensity of irrigation infiltration is 0.000022 m/d; the annual average evaporation is 1410 mm, the evaporation coefficient is 0.04, the evaporation intensity is 0.000016 M/D, and the evaporation limit buried depth is 2.5 M.

The initial flow field of the model is selected from the flow field map obtained from the water level measurement in July 2017 (as shown in Fig. 5).

After running the model for 2 years, the simulated flow field is compared with the actual flow field in July 2019, and the parameters are adjusted. The flow field fitting diagram is shown in Fig. 6. According to the results of model identification, the fitting error of simulated water level is counted, and the proportion of nodes with fitting error less than 0.5 m is more than 75%. From the fitting flow field diagram in identification period, the overall fitting degree of the model is good.

In order to further verify the rationality of the model, the measured water level in July 2019 is selected for verification. The initial flow field of the model is obtained from the measured water level in July 2018. After running for 1 year, the simulated flow field was obtained and fitted with the actual flow field. The fitting figure is shown in Fig. 7. As a whole, the simulated flow field and the actual flow field fit well. Based on the analysis of the flow field fitting in the identification period and validation period, the establishment of groundwater flow model in the simulation area is reasonable and accurate, which can be used for particle tracing simulation.

Fig. 3 Mining zoning of simulation area
Real-time monitoring results of exercise weight loss effect

At present, the main assessment methods of obesity are standard weight method, body mass index, waist hip ratio, and age weight. These methods are no problem for adults, but there are some differences between 7- and 18-year-old students who are still growing up. According to the literature and expert interviews, this study selected Table 5 of obesity examination standard formulated by China International Society for Life Sciences in 2003, which stipulates that the system automatically determines the input requirements of the system according to the data of adolescents, including malnutrition, normal weight, overweight, and other information. The export process of obesity diagnosis can be realized by IMT index based on age, gender, and some conditions.

Discussion

Groundwater vulnerability analysis

Based on the study of vulnerability assessment and groundwater source protection area division in L County, the following conclusions are drawn: according to the characteristics of the study area, dtric-iag model is proposed in this paper (Li and Fang 2014).

The groundwater depth scores in the study area are all above 6, and the groundwater depth is shallow. Among them, 7 points and 8 points are the largest. The former is mainly in the middle of the study area, while the latter is mainly in the west and east of the study area. In the west of the study area, the groundwater depth is the shallowest, so the score is 9 points, and a few areas reach 10 points. The groundwater in the study area is shallow and vulnerable to pollution (Khan and Tahir 2019; Li et al. 2010).

This is because the study area is surrounded by mountains, the terrain slope is large, and it is easy to form surface runoff, resulting in small groundwater infiltration; M river and its tributaries have the highest score of net recharge, because the study area is a “basin” zone, and the water formed by rainfall mainly converges into a river, its height will rise, the water volume will increase, and the groundwater recharge will increase; as the river extends to both banks, the surface runoff decreases and the net recharge decreases. Therefore, along the river to the surrounding, the score gradually decreased (Ahmed et al. 2020).

The M river basin in the middle of the study area is mainly composed of coarse sand with high score and poor anti-pollution performance; the media in mountain seepage area are mainly fine sand and medium fine sand with good permeability; if it continues to extend to the foot of the mountain, there will be some water accumulation due to the terrain, so it has more clay, lower score and stronger anti-pollution performance (Mavor and Gunter 2004).

The hydraulic conductivity is less than 10 m/D in most areas of the study area; the hydraulic conductivity of M river and its tributaries is 30 m/D, which is the largest in the study area.
area; the hydraulic conductivity of other areas is about 1–20 m/d. On the whole, the hydraulic conductivity of aquifers in the study area is relatively small, the hydraulic connection between aquifers is weak, the vulnerability is low, and the anti-pollution ability is strong.

**Real-time monitoring and analysis of exercise weight loss effect**

Experts use the rule-based output method (RBR). In this output method, knowledge is represented as expression rules (Fitzgerald et al. 2005). The general form of generation rule is if. Among them, the hypothesis part represents any model that can match the data, the conclusion part represents the conclusion that can be obtained when the hypothesis is received, and if there is rule trust, it represents the trust level of the conclusion when the hypothesis is received (Fan et al. 2020). The conclusion based on rules is that firstly, according to the output strategy, the corresponding rules are selected from the rule base to make the assumption that they conform to the rules, and finally, the conclusion is drawn according to the corresponding results (Obama 2017). RBR is effective in outputting the events which are expected in advance and accord with the hypothesis of rules. The solution output module is the core of the diet engine expert system, which is also the focus of this study (Cho et al. 2019). The reasoning method adopted by the system is an uncertain reasoning method based on weighted fuzzy logic, which is suitable for representing the uncertainty of engine prescription knowledge. It is an uncertain inference. Considering the complexity problem, the reasoning strategy of the system adopts forward inference (Mukherjee and Misra 2018) (as shown in Fig. 8).
In the output process, the user inputs obesity symptoms and related data, and the system searches all rules matching the obesity symptoms provided by the user and the data on the basis of knowledge. If the matching rules are found, the “hypothetical credibility” (TI) is calculated according to the data input by the user, and if the calculated “hypothetical credibility” is higher than the threshold specified in the rules, the “hypothetical credibility” (TI) is calculated, then the matching is successful. For a successful mapping, there may be many. In some cases, the choice must be based on the size of the credit prerequisite. The system uses the maximum “advance credit” ($T_{max}$) rule for the conclusion and calculates the “credit conclusion” of the conclusion. If it is the final conclusion, the exercise prescription will be output. Otherwise, the conclusion and its conclusion reliability (HI) are written into the fact base as the precondition, and the rule matching is performed again (Dutka 2019).

**Conclusion**

With the improvement of environmental awareness and the development and utilization of groundwater resources, groundwater vulnerability assessment as an important work of groundwater pollution control system has been paid more and more attention. In order to promote the development and utilization of groundwater in L island, we evaluated the vulnerability of groundwater in L island, including the vulnerability of groundwater quality and quantity. It is found that the expert youth diet model is constructed by rule-based...
Fig. 7 Flow field fitting during model validation

Table 5 BMI screening criteria for overweight and obese Chinese students

| Age/years | Severe malnutrition | Innutrition | Male students’ body mass exceeds the standard | Male obesity | Female students’ body mass exceeds the standard | Obesity of female students |
|-----------|---------------------|-------------|-----------------------------------------------|--------------|-----------------------------------------------|--------------------------|
| 7         | 14.5                | 16.0        | 17.4                                          | 19.2         | 17.2                                          | 18.9                     |
| 8         | 14.5                | 16.0        | 18.1                                          | 20.3         | ia 1                                          | 19.9                     |
| 9         | 14.5                | 16.0        | 18.9                                          | 21.4         | 19.0                                          | 21.0                     |
| 10        | 14.5                | 16.0        | 19.6                                          | 22.5         | 20.0                                          | 22.1                     |
| 11        | 14.5                | 16.0        | 20.3                                          | 23.6         | 2L 2                                          | 23.3                     |
| 12        | 14.5                | 16.0        | 21.0                                          | 24.7         | 2L 9                                          | 24.5                     |
| 13        | 14.5                | 16.0        | 21.9                                          | 25.7         | 226                                          | 25.6                     |
| 14        | 14.5                | 16.5        | 22.6                                          | 26.4         | 23.0                                          | 26.3                     |
| 15        | 14.5                | 16.5        | 23.1                                          | 26.9         | 23.4                                          | 26.9                     |
| 16        | 14.5                | 16.5        | 23.5                                          | 27.4         | 23.7                                          | 27.4                     |
| 17        | 14.5                | 16.5        | 23.8                                          | 27.8         | 23.8                                          | 27.7                     |
| 18        | 16.0                | 18.5        | 24.0                                          | 28.0         | 240                                          | 28.0                     |
reasoning method. Under this background, the problem of youth obesity needs to be solved. The traditional healthy diet consultation format provides a key method for training the scientificity of diet, and provides a basis for "stern format" Bruges teenagers. The exercise designated expert system provides obesity diagnosis according to the measurement indicators of teenagers, provides personal exercise programs through the expert system based on the assessor, and provides timely quantitative feedback and constantly adjusts the diet for exercise. It is worthy of popularization and application, so that the healthy diet effect of young people can finally be realized.

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Conflict of interest The authors declare no competing interests.

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