that nearly half students' dairy product intake was
lower, above quarter students excessively took in sweets, and
even fewer students took in deep-fry and pickled food every
day. Half the students strenuous exercise amount was not
even enough, above half students didn’t participate in extracurric-
ular exercises, and as students’ ages increased, phenomenon of
not participating in physical exercise became even more seri-
ous [5]. At the same time, it indicated that schoolgirls physical
exercise level was even lower than that of schoolboys. The writer pointed out that it was very necessary to
develop dietary education and physical exercise ideological
education targeted at teenagers.

In 2013, Xu Ya-Nan researched on elementary and sec-
ondary school students’ food safety education problem.
Firstly it explained food safety current status, and then ap-
plied multiple research methods to carry out questionnaire
survey on Nanjing city elementary and secondary school
students, finally, targeted at present problems, it presented
solution. Investigation result indicated that local primary and
secondary school students’ emphasis on food safety was high,
but in students’ contiguous education, school food safety
education ranked the last. Most of students suggested
integrating food safety education into physical health educa-
tion course [6-8].

The paper will adopt questionnaire survey, research on
physical exercises and dietary necessity, and pointed out
current existing issues and presented corresponding coun-
termeasures.

2. QUESTIONNAIRE SURVEY AND RESULTS
Take Beijing, Shanghai, Guangzhou, Shenzhen, Shijia-
zhuan, Tianjin and Baotou these seven cities as investiga-
tion sites, regard university students as investigation objects,
questionnaire contents include daily dietary behaviors and
physical exercises behaviors.
Table 1. Dietary habits investigation result table.

| City              | Cereal<250g | Fruit and vegetable<350g | Protein<70g | Fried food>50g | Sugared beverage>50g |
|-------------------|-------------|---------------------------|-------------|----------------|---------------------|
| Beijing           | 35%         | 21%                       | 15%         | 26%            | 29%                 |
| Shanghai          | 28%         | 19%                       | 13%         | 21%            | 27%                 |
| Guangzhou         | 46%         | 15%                       | 10%         | 19%            | 31%                 |
| Shenzhen          | 39%         | 20%                       | 12%         | 16%            | 35%                 |
| Shijiazhuang      | 26%         | 25%                       | 25%         | 29%            | 29%                 |
| Tianjin           | 29%         | 29%                       | 23%         | 32%            | 23%                 |
| Baotou            | 35%         | 35%                       | 19%         | 23%            | 28%                 |

Table 2. Physical exercises behaviors investigation result table.

| City             | Strenuous exercises<20min | General exercises<40min | Physical exercises<50min | Electronic entertainment>100min |
|------------------|---------------------------|--------------------------|---------------------------|--------------------------------|
| Beijing          | 80%                       | 65%                      | 69%                       | 86%                            |
| Shanghai         | 76%                       | 68%                      | 72%                       | 79%                            |
| Guangzhou        | 83%                       | 59%                      | 79%                       | 83%                            |
| Shenzhen         | 79%                       | 52%                      | 68%                       | 76%                            |
| Shijiazhuang     | 89%                       | 74%                      | 83%                       | 89%                            |
| Tianjin          | 82%                       | 69%                      | 76%                       | 84%                            |
| Baotou           | 91%                       | 64%                      | 80%                       | 81%                            |

2.1. Investigation Contents

Use year 2001 American disease control center’s teenagers’ dangerous behaviors questionnaire survey as evidence, combine with Chinese current status, and designs questionnaire survey contents. Among them, daily dietary habits investigation contents include cereal intake amount less than 250 gram, fruit and vegetable intake amount less than 350 gram, protein intake amount less than 70 gram, sugared beverage intake amount above 50 gram, fried and other junk food intake amount above 50 gram. Physical exercises investigation contents include strenuous exercises less than 20 minutes, general exercises less than 40 minutes, physical exercises less than 50 minutes, watching TV and surfing online such entertainment time above 100 minutes [7].

2.2. Investigation Results

Respectively random sample 100 university students in each investigation site, and fill out questionnaire anonymously. Subject in questionnaire independently completes questionnaire to ensure questionnaire survey results validity. Sort out and make statistics of investigation results, it can get investigation result as Table 1, Table 2 shows.

From Table 1, it is clear that all regions university students’ dietary structure has certain differences. Guangzhou students lack of cereal intake, Baotou students lack of fruit and vegetable intake, Shijiazhuang students lack of protein intake, Tianjin students fried food intake amount is larger, and Shenzhen students’ sugared beverage intake amount is larger.

From Table 2, it finds out that Baotou students lack of strenuous exercises, Shijiazhuang students lack of general exercises and physical exercises as well as take too long time in electronic entertainment.

3. PRINCIPAL COMPONENT ANALYSIS

Main thought of principal component analysis is variable’s dimension reduction. It is a statistical analysis method that transforms multiple variables into fewer main variables. It generally is used to data compression, system evaluation, regression analysis and weighted analysis so on.

3.1. Definition of Principal Component Analysis Approach

May way of principal component analysis is reducing dimension of variables, which is recombining original many variables with correlation into a group of uncorrelated variables to replace original variables. Therefore, we can pay attention to every time observation’s variables that have maximum variation, to every time observation’s small changed variables that can be used as constant to process and get rid of them, so that it reduces variables number in question that needs to be considered.
Assume that there is \( m \) pieces of original indicators to do principal component analysis, which are recorded as \( x_1, x_2, \cdots, x_m \), now it has pieces of samples, corresponding observation value is \( x_{ik} \) \((i = 1,2, \cdots, n)\), and \( k = 1,2, \cdots, m \) takes standardization transformation, and then transform \( x_k \) into \( x_k^* \), that:

\[
x_k^* = \frac{x_k - \bar{x}_k}{s_k}, \quad k = 1,2, \cdots, m
\]  

Among them, \( x_k \) and \( s_k \) are respectively \( x_k \) average number and standard deviation, \( x_k^* \) average number is 0, standard deviation is 1.

According to each sample original indicator observation value \( x_{ik} \) or after standardization observation value \( x_{ik}^* \), it solves coefficient \( b_{ik} \), establish indicator \( x_k^* \) that is transformed through standardization to express comprehensive indicator \( z_j \) equation

\[
z_j = \sum_k b_{kj} x_k^* + a_j
\]

which can also establish equation that uses original indicator \( x_k \) to express comprehensive indicator \( z_j \)

\[
z_j = \sum_k \tilde{b}_{kj} x_k + a_j
\]

There are two requirements on defining:

1. Comprehensive indicators are mutual independent from each other or uncorrelated.
2. Every comprehensive indicator reflected each sample gross information content is equal to corresponding feature vector (comprehensive indicator coefficient) feature values. In general, it is required that selected comprehensive indicator feature vales contribution ratios sum to be above.

3.2. Principal Component Analysis General Steps

1. According to observed data, calculate \( \bar{x}_k \) and \( s_k \) \((k, j = 1,2, \cdots, m)\).
2. By correlation coefficient matrix, it can get feature value \( R \) and \((j = 1,2, \cdots, m)\) each principal component variance contribution, contribution ratio and accumulative contribution ratio, \( p \) and define principal component reserved number with accumulative contribution ratio as evidence.
3. \( m \) pieces of basic equations are as following:

\[
\begin{align*}
 r_{11} x_1^{(j)} + r_{12} x_2^{(j)} + \cdots + r_{1m} x_m^{(j)} &= \lambda_j x_1^{(j)} \\
r_{21} x_1^{(j)} + r_{22} x_2^{(j)} + \cdots + r_{2m} x_m^{(j)} &= \lambda_j x_2^{(j)} \\
&\quad \cdots \\
r_{m1} x_1^{(j)} + r_{m2} x_2^{(j)} + \cdots + r_{mm} x_m^{(j)} &= \lambda_j x_m^{(j)}
\end{align*}
\]  

Among them, \( j = 1,2, \cdots, m \).

Proceed with Schmidt orthogonalization, for every \( \lambda_j \), solve its basic equations solution \( x_1^{(j)}, x_2^{(j)}, \ldots, x_m^{(j)} \) \((j = 1,2, \cdots, m)\),

and then let

\[
b_{kj} = \frac{x_k^{(j)}}{\sqrt{\sum_k (x_k^{(j)})^2}}
\]

It can get expressed by \( x_1^*, x_2^*, \ldots, x_m^* \) principal component

\[
z_j = \sum_k b_{kj} x_k^*,
\]

or input

\[
x_k^* = \frac{x_k - \bar{x}_k}{s_k}
\]

and then get \( x_1^*, x_2^*, \ldots, x_m^* \) expressed principal component.

4. Input \( x_1, x_2, \ldots, x_m \) observed values into principal component expressions, calculate each component value.

5. Calculate original indicator and principal component correlation coefficient that is also factor loading so that explain principal component significances.

3.3. Principal Component Analysis Result

For dietary habits investigation result, it makes principal component analysis; result is as Fig. (1) shows.
In Fig. (2), “1” represents strenuous exercises, “2” represents general exercises, “3” represents physical exercises, “4” represents electronic entertainment. From Fig. (2), it is clear that strenuous exercise and general exercise are main factors that affect physical exercises.

In the following, utilize neural network model, establish evaluation model targeted at dietary habits and physical exercises.

4. NEURAL NETWORK MODEL

4.1. Neural Network Model Concept

Neural network model is originated from neurobiology. Its computation process is similar to biology nerve cell reaction process. In neural network, lots of different nerve cells contained axon ends could enter into the same nerve cell Dendron and form into lots of synapses. All synapses of different origins liberative neurotransmitter can exert effects on same nerve cell membrane potential. Therefore, it is clear that nerve cell space integrated information capacity that nerve cell can make integration on input information of different origins in Dendron. Base on the capacity, people imitate nerve cell reaction process and create artificial nerve cell model as Fig. (3) shows. Symbols description in Figure is as Table 3.

![Fig. (3). The schematic of mathematical models of neurons.](image)

Table 3. Mathematical model’s symbol definition.

| Symbol | Definition |
|--------|------------|
| $x_i, x_2, \ldots, x_n$ | Nerve cell input part that is information released by previous level |
| $\theta_i$ | Nerve cell threshold value |
| $y_i$ | Nerve cell output |
| $f[a_i]$ | Excitation function |

$f[a_i]$ decides that output form that arrives at threshold value $\theta_i$ under common effects of inputting $x_1, x_2, \ldots, x_n$. Fig. (4) shows two kinds of excitation functions images. The paper adopted models use the second kind excitation function.

![Fig. (4). Typical excitation functions.](image)

Among them,

$$u_i = \sum w_{ij} x_j - \theta_i \quad (5)$$

Therefore

$$y_i = f[u_i] = f(\sum w_{ij} - \theta_i) \quad (6)$$

Formula (2) is individual nerve cell full mathematical model expression.

4.2. BP Neural Network Model Computational Steps

BP Neural network is a kind of multiple layer forward network, adopts minimum mean square error computational way. When apply counter propagation algorithm into feed forward multiple network, utilize Sigmoid as excitation function, use following steps to make recursion solving on $w_{ij}$ that is network weight coefficient. In case every layer has $n$ pieces of nerve cells, for the $k$ layer the $i$ nerve cell, then it has $n$ pieces of weight coefficients $w_{i1}, w_{i2}, \ldots, w_{in}$. In addition, select one more $w_{i0}$ to express $\theta_i$. When input sample $x$, take $x = \{x_1, x_2, \ldots, x_n, 1\}$.

1. Align value to $w_{ij}$. To every layer $w_{ij}$, align a very little nonzero random number, and meanwhile $w_{i0} = -\theta_i$.

Due to the model utilizes Matlab to operate, the alignment process is computer’s random process, and just because of that, same programming codes in different running processes, the results may appear differences.
Input sample value \( x = (x_1, x_2, \ldots, x_n) \), and corresponding expected output \( y = (y_1, y_2, \ldots, y_n) \).

Calculate each layer output, for the \( k \) layer the \( i \) nerve cell output \( x_{ik} \), it has:

\[
y^k_i = f(u^k_i)
\]

Among them,

\[
u^k_i = \sum_j w_{ij} x^{k-1}_j - \theta^k_i
\]

In formula, \( x^{k-1}_{n+1} = 1 \), \( w_{i(n+1)} = -\theta^k_i \)

1. Solve each layer computation error \( d^k_i \), for output layer, it has \( k = m \), then it has:

\[
d^m_i = x^m_i (1-x^m_i)(x^m_i - y^m_i)
\]

For other layers, it has

\[
d^k_i = x^k_i (1-x^k_i)(\sum_j w_{ij} x^{k-1}_j - \theta^k_i)
\]

5. Correct \( w_{ij} \) and \( \theta^k_i \), it has

\[
w_{ij}(t+1) = w_{ij}(t) - \eta d^k_j x^{k-1}_j
\]

6. After solving each layer each weight coefficient, it can judge whether it conforms to requirements according to established criterion. If it don’t conform, then return to the step 3, on the contrary, end computing.

4.3. Model Establishment

Regard dietary habits and physical exercises principal components as evaluation objects that dietary habits is vertical coordinate, physical exercises is horizontal coordinate. According to experiences, set up dietary habits and physical exercises feature values, feature values distribution is as Fig. (5).

Input principal component analysis result factor parameters into the model, through Matlab operational calculation, and then can get Fig. (6).

CONCLUSION

It is clear from Figure 6 that Shenzhen is a city of better physical exercises and dietary habits that lies in the bottom of boundary, but closely links to boundary. Except for Shenzhen, Beijing, Shanghai, Guangzhou, Shijiazhuang, Tianjin and Baotou, all of them don’t reach the standard; thereupon it is clear about necessity of China developing physical exercises and dietary habits. The paper utilizes principal component analysis approach, takes BP neural network as theoretical basis, establishes evaluation model, states theoretically Chinese physical exercises and dietary habits current status. As far as practical life issues are concerned, it still needs to make specific analysis and presents corresponding improvement measures.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

ACKNOWLEDGEMENTS

This work is supported by the Key Project of Guangxi Social Sciences, China (No.gxsk201424), the Education Science fund of the Education Department of Guangxi, China (No.2014JGA268), and Guangxi Office for Education Sciences Planning, China (No.2013C108).

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Received: May 26, 2015 Revised: July 14, 2015 Accepted: August 10, 2015

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