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EXPLORATION OF THE INTERVENTION EFFECT OF GOLDEN INULIN ON INFLAMMATION INDEXES OF ACNE PATIENTS BASED ON INTESTINAL FLORA

Annotation: *This paper discusses the changes of intestinal flora and inflammation indicators in patients with acne after receiving the honeysuckle and chrysanthemum powder intervention. In this experiment, 6 patients with acne were included in the experimental group and 4 healthy subjects as the control group. The subjects were tested for 16S gene sequencing before and after the intervention of the honeysuckle and chrysanthemum powder. According to the Shannon index and the proportion of the bacteria group. The changes were judged by the influence of the intervention of the honeysuckle and chrysanthemum powder on the intestinal flora of the tested population, and the changes of inflammatory factors were determined to determine the effect of the honeysuckle and chrysanthemum powder on the inflammatory index. For the acne patients, most patients with acne reflected mild symptoms of facial symptoms; the individual's inflammation index interleukin-6 (IL-6) decreased by 19.40% to*

59.07%, the vast majority of patients The concentration of Tumor necrosis factor-α (TNF-α) decreased by more than 30%; the Shannon index of intestinal flora after the honeysuckle and chrysanthemum powder intervention was significantly different from that before intervention, the patient's Shannon index generally declined; Dorea and Fusobacterium The proportion of microflora showed a downward trend. In summary, the intervention of the honeysuckle and chrysanthemum powder inhibited the growth of the flora associated with proinflammatory effects in the intestinal tract of acne patients, which reduced the level of inflammatory factors and relieved the symptoms of acne patients.

Key words: *The honeysuckle and chrysanthemum; Acne; Inflammatory factor; Intestinal flora; Golden inulin.*

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ИЗУЧЕНИЕ ВЛИЯНИЯ ЗОЛОТИСТОГО ИНУЛИНА НА ПОКАЗАТЕЛИ ВОСПАЛЕНИЯ У ПАЦИЕНТОВ С АКНЕ НА ОСНОВЕ КИШЕЧНОЙ ФЛОРЫ

Аннотация: *В данной статье рассматриваются изменения кишечной флоры и показателей воспаления у пациентов с акне (угревой сыпью) после*

приема порошка жимолости и хризантемы. В этом эксперименте 6 пациентов с акне были включены в экспериментальную группу, а 4 здоровых человека - в контрольную группу. Испытуемые были протестированы на последовательность генов 16S до и после применения порошка жимолости и хризантемы по индексу Шеннона и доле группы бактерий. По изменениям судили о влиянии вмешательства порошка жимолости и хризантемы на кишечную флору пациентов, а по изменениям факторов воспаления определяли влияние порошка жимолости и хризантемы на индекс воспаления. Что касается пациентов с акне, то у большинства пациентов с акне наблюдались легкие симптомы на лице; индекс воспаления интерлейкина-6 (IL-6) снизился на 19,40% до 59.07%, у подавляющего большинства пациентов концентрация фактора некроза опухоли-α (TNF-α) снизилась более чем на 30%; индекс Шеннона кишечной флоры после вмешательства порошка жимолости и хризантемы значительно отличался от такового до вмешательства, индекс Шеннона пациента в целом снизился; Dorea и Fusobacterium Доля микрофлоры показала тенденцию к снижению. В итоге, вмешательство порошка жимолости и хризантемы подавило рост флоры, связанной с воспалительными эффектами в кишечном тракте пациентов с акне, что снизило уровень воспалительных факторов и облегчило симптомы пациентов с акне.

Ключевые слова: *Жимолость и хризантема; акне; воспалительный фактор; кишечная флора; золотистый инулин.*

1. Introduction

1.1 Acne

Acne is a common chronic inflammatory skin disease that occurs in hair follicle sebaceous glands among adolescents[1, p. 38]. Acne has bothered many young people, and foreign studies indicate that the incidence of acne in adolescents aged 12 to 24 is up to 85%[2, p. 167]. Most acne patients believe that acne has increased their psychological pressure and risk of depression and anxiety and become one of the factors that affect their daily social communication[3, p. 50]. 82.60% of college students believe that acne will affect their employment, social interaction, study, and other aspects while 20.50% think that it will cause serious psychological disorders[4, p. 60].

Nowadays, the most commonly applied acne treatment method in medicine is to use isotretinoin and other drugs, but they have certain side effects. Previous studies demonstrate that larger doses can help improve skin lesions as quickly as possible, but adverse reactions will increase accordingly[5, p. 266]. Relevant studies have indicated that the application of isotretinoin remarkably increases the risk of depressive symptoms in patients[6, p. 53]. Therefore, it is of great social significance to investigate and develop healthy foods that can improve acne.

Numerous factors can lead to the occurrence of acne, most of which can ultimately be attributed to the inflammatory response. Hormone imbalance and abnormal keratinization of sebaceous glands can cause abnormal sebum secretion, which can easily block hair follicles and cause inflammatory responses; microbial infections and immune disorders will trigger immune responses or

hypersensitivity reactions in the corresponding parts of the body, thus resulting in inflammations[7, p. 31]. Notably, the inflammatory response is the core of the acne pathogenesis process.

Previous research on inflammation and acne indicates that all skin lesions including subclinical skin lesions in acne have inflammatory reactions[8, p. 68]. According to the Affinal Drug and Food Catalog published by the National Health Commission, chrysanthemum and honeysuckle are identical products that have the effect to relieve inflammation or internal heat, as indicated in modern medicine. Honeysuckle has anti-inflammatory and antipyretic effects and can lower blood lipid, promote the secretion of gastric juice and bile, enhance the immune function of the body, improve phagocytosis of inflammatory cells, and inhibit abnormal reaction[9, p. 798], whereas wild chrysanthemum has various pharmacological effects and has been clinically commonly applied for anti-bacteria and anti-inflammation[10, p. 906].

Meanwhile, more and more research on the gut-brain-skin axis has demonstrated that intestinal dysbiosis will cause the occurrence of acne, and numerous factors that can theoretically affect the gut, brain, or skin can affect the gut-brain-skin axis, e.g. diet, light, age, mental stress, drugs, and the environment[11, p. 365]. Notably, the gut microbiome is the most complex and populous symbiotic microbial ecosystem in the human body and an essential factor in body health and homeostasis. As a micro-ecosystem, the gut microbiota also has homeostasis, ecological drift, and restoration[12, p. 398]. At present, some experts and scholars believe that intestinal function disorder is a pathogenic

factor of inflammatory bowel disease[13, p. 553]. Therefore, it is of great practical significance to further clarify the characteristics of the intestinal flora of acne patients.

From the perspective of food specialty, this paper explores the effect of edible golden inulin on acne patients and clarifies the impact of golden inulin on the intestinal flora and inflammation indicators of acne patients to lay a theoretical foundation for the subsequent development of food, effectively improve the acne symptoms, and eradicate the problem of acne treatment.

1.2 Research Status and Existing Problems at Home and Abroad

The existing research indicates that the following factors can change the intestinal flora homeostasis, thus resulting in inflammation, i.e. antibiotics that can change the intestinal flora, other drugs that can destroy the intestinal flora and the intestinal mucosa, high-fat and high-sugar food can damage the intestinal flora and cause intestinal leakage and internal inflammation, thus leading to external acne. Relevant studies suggest that when the intestinal barrier function is impaired, the dynamic imbalance between the intestinal microecology and the host will occur, thereby triggering the onset of the disease; when the dynamic balance is restored, it might become an essential means to treat diseases[14, p. 293]. In recent studies, it is found that gut microbes can enhance the presence of circulating endotoxins in the blood of acne patients[15, p. 50].

Nonetheless, the majority of the existing studies on acne treatment summarize the effect of patients' external skin characteristics from the perspective of medicine. The research on the effect of honeysuckle and chrysanthemum on

acne is insufficient, which is mainly conducted by applying medicinal substances including herbal medicine to treat patients through surface penetration into their affected area from the perspective of Chinese medicine science. Wu Chengyi and other scholars extracted effective ingredients from honeysuckle and wild chrysanthemum and mixed it with cream matrix to make an ointment, and the results indicated that the acne treatment rate is 76.7% without obvious toxic and side effects[16, p. 53]. The Department of Traditional Chinese Medicine of the First Hospital of Handan City, Hebei Province, applied the golden inulin capsule to treat 120 patients with an efficiency rate of 100%[17, p. 856].

Most of the previous characteristic analyses of intestinal microbiota in acne patients mainly focus on analyzing the differences between them and healthy people without longitudinal analyses of the intestinal flora and inflammatory indicators after they receive the intervention. The Peking University Third Hospital applied high-throughput sequencing analysis to compare the differences in intestinal flora between acne vulgaris patients and healthy people, finding substantial differences in the relative abundance of intestinal flora but none in intestinal flora diversity between the two groups[18, p. 2]. The research by Southwestern Medical University showed that the intestinal microbial richness in patients with acne vulgaris remarkably decreased compared with the healthy control group[19, p. 10].

This research aims to determine the effect of golden inulin on intestinal flora and inflammatory indicators in acne patients through golden inulin intervention. The effect of golden inulin on the affected area was determined according to the

facial skin status record; the concentration level of the inflammatory cytokines TNF-α and IL-6 was determined by an enzyme-linked immunization kit to judge the effect of golden inulin on human inflammation indexes; the raw 16S gene sequencing data to were utilized to analyze the changes of the Shannon estimation index and the proportion of the flora after the intervention between the two groups; the relationship between the intestinal flora and the inflammation index and the occurrence of acne was preliminarily explored to lay a theoretical basis for the future development of anti-acne food.

1.3 Study Content

This research applied golden inulin to the intervention of the two groups to compare the changes in the facial or affected skin status between the two groups during the same period, thus demonstrating the effect of golden inulin on the affected area; the changes in the concentration of inflammatory cytokines TNF-α and IL-6 was examined by the enzyme-linked immunization kit; the 16S gene sequencing data was analyzed to longitudinally compare individual gut microflora changes, thus determining the effect of the intervention on the intestinal microflora diversity and the proportion of intestinal flora of acne patients after golden inulin intervention; the effect of golden inulin on the intestinal flora and inflammatory indicators in acne patients was clarified through the relationship of microflora on human inflammation.

The research aims to explore the relationship between intestinal flora and inflammation and the occurrence of acne in the body, thus laying a foundation for the future development of more effective food to treat acne from the perspective

of the intestine and providing certain theoretical references for fundamentally tackling the perennial acne.

2. Materials and Methods

2.1 Materials and Reagents

2.1.1 Experimental Materials

Sample source: Samples were collected from local college students.

Stool samples of volunteers: Stool samples of volunteers before and after golden inulin intervention.

Blood samples: 10 mL of blood samples before and after golden inulin intervention.

Experimental food raw materials: The top-level dried chrysanthemum and honeysuckle, which belong to affinal medicine and food, were purchased online and then crushed with a cooking machine to make capsules for volunteers to take.

2.1.2 Experimental Reagents

Table 2-1 Experimental Reagents

Reagent name	Manufacturer	Application
Human IL-6 ELISA (Enzyme-Linked Immunosorbent Assay) kit	Anhui Qiaoyi Biotechnology Co., Ltd.	The measurement of IL-6 concentration in the serum
Human TNF-α ELISA	Anhui Qiaoyi	The measurement of

2.2

(Enzyme-Linked Immunosorbent Assay) kit	Biotechnology Co., Ltd.	TNF-α concentration in the serum

Instruments and Equipment

Table 2-2 Experimental Instruments and Equipment

Instrument name	Model	Manufacturer
Table-top high speed centrifuge	H650-W	Hunan Xiangyi Laboratory Instrument Development Co., Ltd.
Refrigerator	NR-C33PX3-NL	Panasonic Co., Ltd.
Multi-function microplate reader	Varioskan Flash	Thermo Fisher Scientific, USA

2.3 Experimental Methods

Six acne patients were collected as study subjects, four healthy people as the control group. All the study subjects were local college students who volunteered to participate in the present study and signed the experimental volunteer agreement. The volunteers were at the same age and had similar living environments.

Before the experiment, the volunteers signed the Cooperation Agreement on the Study of Gastrointestinal Bacterial Status of Acne Patients. They had not taken antibiotics during the two weeks before the experiment and had no gastrointestinal diseases.

2.3.1 Anti-inflammatory Food Intervention

Top-level honeysuckle and chrysanthemum powder were placed into edible capsules, and the experimental volunteers were arranged to take them for 7 days.

Sampling: Before and after the anti-inflammatory stage, the volunteers applied the special sterile sampler by Hegu Information to obtain stool samples. According to the experimental arrangement, the hospital staff helped take 10 mL of blood samples from the volunteers before and after the golden inulin intervention.

2.3.2 Facial Skin State Record

Facial skin photos: Pictures of the affected facial area were taken before the volunteers received the golden inulin intervention; for the acne patients, the pictures of the obvious affected facial areas were taken. After the volunteers received the golden inulin intervention, the same facial areas were photographed again.

2.3.3 The Measurement of the Concentrations of Inflammatory Factors IL-6 and TNF-α in Human Serum

Interleukin 6 (IL-6) is a type of multifunctional protein that plays an essential role in host defense, acute phase response, immune translation, hematopoietic function, nervous system, and other aspects.

Tumor necrosis factor-α (TNF-α) is a peptide cytokinine generated by monocytes and macrophages, which plays an essential part in inflammatory kines, the development of the immune system, programmed cell death, and lipid metabolism. TNF-α plays an important role in the pathogenesis of inflammation

in arthritis and other tissues and it is also involved in the development of diseases including asthma, Crohn's disease, rheumatoid arthritis, neuropathic pain, obesity, diabetes, autoimmune disease, and carcinomas.

(1) Human Serum Collection

Volunteers were sent to the hospital, from whom 10 mL of blood samples were collected before and after the intervention. The samples were placed in a 4℃ environment for 30 min before being centrifuged for at 4,000 r/min 15 min, and the supernatant was stored at -20℃. Afterward, the concentrations of the inflammatory factors TNF-α and IL-6 in serum were examined applying an enzyme-linked immunoassay kit.

(2) Preparations before Testing

The kit was removed from the refrigerator and equilibrated at room temperature (25~28℃) for 20 min and was diluted with the 5× standard diluent of deionized water. The standard diluent was used to redissolve it according to the dissolution volume at strictly controlled room temperature of 25℃to 28℃, gently suspended for 15 to 20 min, suctioned several times for thorough dissolution. After being diluted with the standard diluent through the doubling gradient dilution method, the solution was added to the detection hole successively (the seven-point standard curve and the standard diluent directly added as 0 concentration) with 300 μL of washing liquid per well. The injection and suction were conducted at an interval of 15 to 30 seconds. After the last panel washing, the panel was inverted on the thick water-absorbing paper.

(3) Detection

First, different concentrations of standard substance (100 μL/well) were added to the corresponding wells, and the reaction wells were sealed with sealing paper and incubated at room temperature (25~28°C) for 120 min for dual-mode compound detection.

After 50 μL buffer for serum sample analysis was added to the corresponding holes, 50 μL of human serum samples collected before the intervention and 50 μL after the intervention were added for the double hole detection. Then, the plate was washed 5 times and dried with the thick water absorption paper after the fifth washing.

Biotinylated antibody working fluid (100 μL /well) was added, and the reaction wells were sealed with sealing paper and incubated at room temperature (25~28°C) for 60 min. Then, the plate was washed 5 times and dried with the thick water absorption paper after the fifth washing. RP enzyme conjugate working fluid (100 μL/well) was added, and the reaction wells were sealed with sealing sheet paper and incubated at room temperature (25~28°C) for 20 min. Then, the plate was washed 5 times and dried using the thick water-absorbing paper after the fifth time.

The color developing agent TMB was added (100 μL/well) and incubated at room temperature (25~28°C) for 20 min. The suspension solution was added (50 μL/well) and intensively mixed, and the OD 450 was measured immediately.

(4) Plotting of the Standard Curve

The standard curve was plotted after the subtraction of the OD value of the

background correction hole from the OD value of each standard substance and specimen. With the standard concentration as the abscissa and the OD value as the ordinate, the coordinate point of each standard product was connected with a smooth line. The concentration of the specimen can be found on the standard curve according to its OD values.

2.3.4 Analysis of Intestinal Flora Data

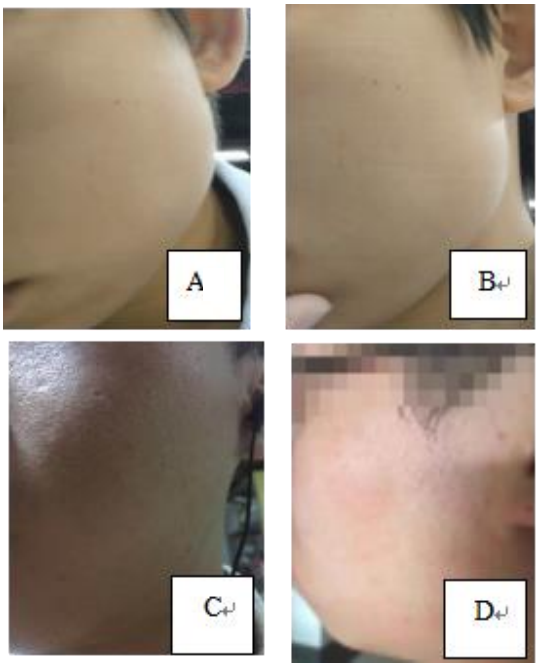
Due to the limited experimental conditions, in this study, the stoop samples collected from the volunteers were sent to Hangzhou Guhe Information Technology Co., Ltd. for 16S gene sequencing. According to the experimental needs, the samples were divided into the experimental group (volunteers with acne) and the control group (healthy volunteers). The samples in each group were detected to compare the influence of golden inulin on the intestinal flora between the two groups according to the Alpha diversity analysis Shannon index and flora proportion data analysis.

3. Results and Analysis

3.1 Photo Recording of Facial Skin Status

During the experiment, the facial skin changes of the volunteers before and after receiving the golden inulin intervention were recorded and the experimental feedback was collected to determine the effect of the golden inulin on the facial skin of the two groups. No adverse effects or facial skin diseases like acne were found on the facial skin status of healthy volunteers. The facial photo records of healthy volunteer 1, healthy volunteer 3, and acne patients 3 and 4 after the intervention of golden inulin are randomly presented in Figure 3-1 and Figure 3-

2. In comparison, the symptoms of the affected facial area of the acne patients were slightly relieved after receiving golden inulin intervention. According to the physical and mental feedback during the experiment, most of the acne patients had no poor physical or mental conditions after receiving the golden inulin intervention. Among most of the volunteers, the incidence of new acne decreased or the original red and swollen acne subsided.



A. Healthy volunteer 1 before the intervention

B. Healthy volunteer 1 after the intervention

C. Healthy volunteer 3 before the intervention

D. Healthy volunteer 3 after the intervention

Figure 3-1 Facial photographs of some healthy volunteers before and after the intervention

E Acne patient 3 before the intervention

F Acne patient 3 after the intervention

G Acne patient 4 before the intervention

H Acne patient 4 after the intervention

Figure 3-2 Facial photographs of some acne patients before and after the intervention

3.2 Effects of Golden Inulin on Inflammatory Indicators

In this experiment, the effect of golden inulin on inflammatory indicators was evaluated based on the changes in the inflammatory factors before and after the intervention. The blood samples were collected from the volunteers before and after the inflammatory intervention, and the processed serum samples were detected to obtain the concentrations of the human inflammatory factors IL-6 and TNF-α. As indicated by the values of the inflammatory factors in the healthy

group before and after the golden inulin intervention concentration in Table 3-1, the levels of IL-6 and TNF-α of the volunteers in this group decreased after the golden inulin intervention.

Table 3-2 presents the data on the inflammatory factor concentrations of the volunteers in the acne patient group before and after the intervention. The results indicate that individuals in the acne patient group had lower levels of inflammatory factors after the golden inulin intervention. After comparative analysis, it was found that the concentration of the inflammatory factor IL-6 decreased by 19.40% to 59.07% in the acne patient group while that of the inflammatory factor TNF-α concentration exceeded 30% except patient 4, as shown in Figure 3-3. Golden inulin decreased the levels of inflammatory factors IL-6 and TNF-α in the two groups of subjects, hence golden inulin has significant anti-inflammatory effects on acne patients.

Table 3-1 The concentrations of inflammatory factors in the healthy group before and after the intervention

Volunteers	IL-6 before the intervention (pg/mL)	IL-6 after the intervention (pg/mL)	TNF-α before the intervention (pg/mL)	TNF-α after the intervention (pg/mL)
Healthy volunteer 1	49.87	39.87	17.00	10.79
Healthy volunteer 2	123.20	126.20	16.85	13.97
Healthy volunteer 3	28.53	28.53	16.24	14.73
Healthy volunteer 4	61.87	61.87	14.88	13.67

Table 3-2 The concentrations of inflammatory factors in the acne patient group before and after the intervention

Volunteers	IL-6 before the intervention (pg/mL)	IL-6 after the intervention (pg/mL)	TNF-α before the intervention (pg/mL)	TNF-α after the intervention (pg/mL)
Acne patient 1	31.53	17.20	27.91	15.03
Acne patient 2	44.53	33.20	108.82	23.82
Acne patient 3	71.20	42.32	74.88	12.15
Acne patient 4	24.53	12.20	15.18	13.67
Acne patient 5	48.53	19.87	28.06	17.91
Acne patient 6	61.87	49.87	33.82	18.67

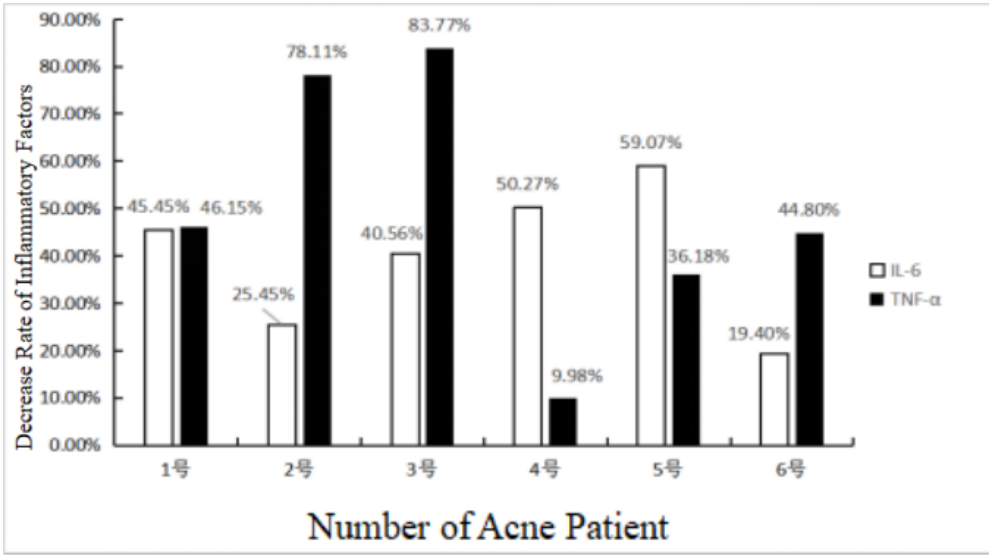


Figure 3-3 Increment of inflammatory factors in the acne patients after the intervention

3.3 Effect of Golden Inulin on the Intestinal Flora

3.3.1 Changes in the Shannon Index of the Intestinal Flora

The changes in the Shannon index selected in this analysis reflect whether the intestinal flora diversity of the subject population has changed regularly after the golden inulin intervention. The Shannon index can reflect the flora diversity, i.e. the larger the index, the higher flora diversity.

Figure 3-4 compares the Shannon index of the intestinal flora in the healthy population group before and after the golden inulin intervention. The results indicated that the Shannon index of the intestinal flora changed regularly before and after the golden inulin intervention, i.e. except for healthy volunteer 1, the Shannon index of healthy volunteers 2, 3, and 4 slightly decreased. Therefore, the Shannon index of the healthy volunteers generally showed a downward trend after the golden inulin intervention. However, there was no significant difference in the Shannon index, the Alpha diversity analysis index, of the healthy group before

and after the golden inulin intervention (P>0.05).

Figure 3-5 compares the changes in the Shannon index of the acne patient group before and after the anti-inflammatory food treatment, finding that the Shannon index of the intestinal flora changed significantly after the anti-inflammatory food treatment (P=0.046, <0.05). The intestinal flora diversity Shannon index of most acne patients declined, among whom acne patients 1, 2, 3, and 5 showed a significant increment while acne patient 6 showed a small increment. Therefore, golden inulin has a significant impact on intestinal flora diversity in acne patients, i.e. it reduces the intestinal flora diversity in acne patients.

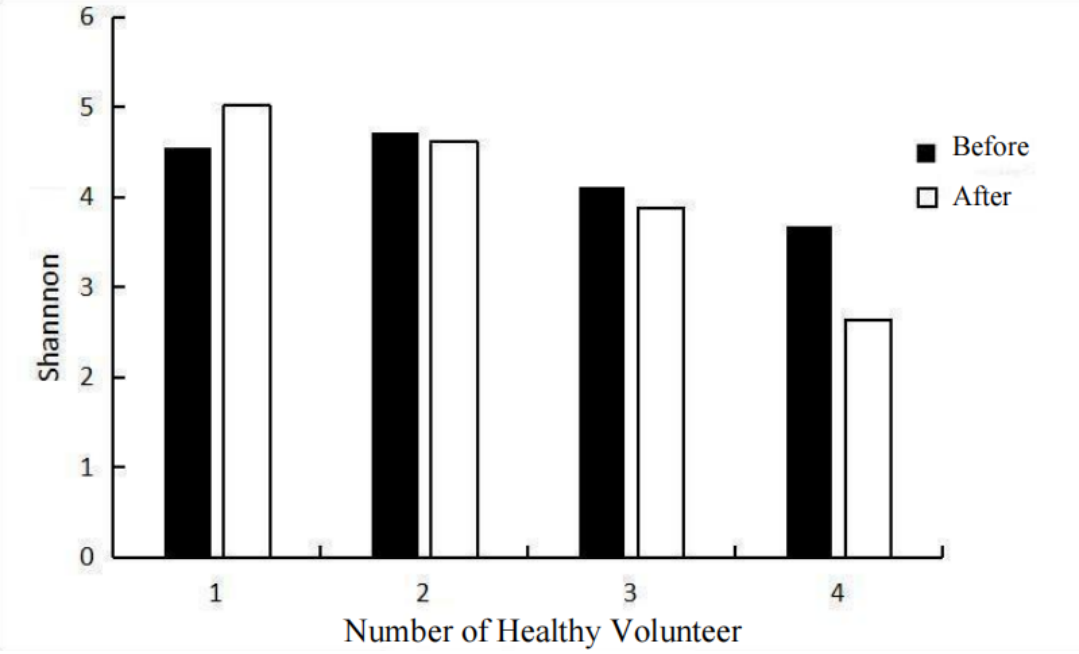


Figure 3-4 Comparison of the Shannon index of the intestinal flora in healthy individuals before and after the anti-inflammatory food treatment

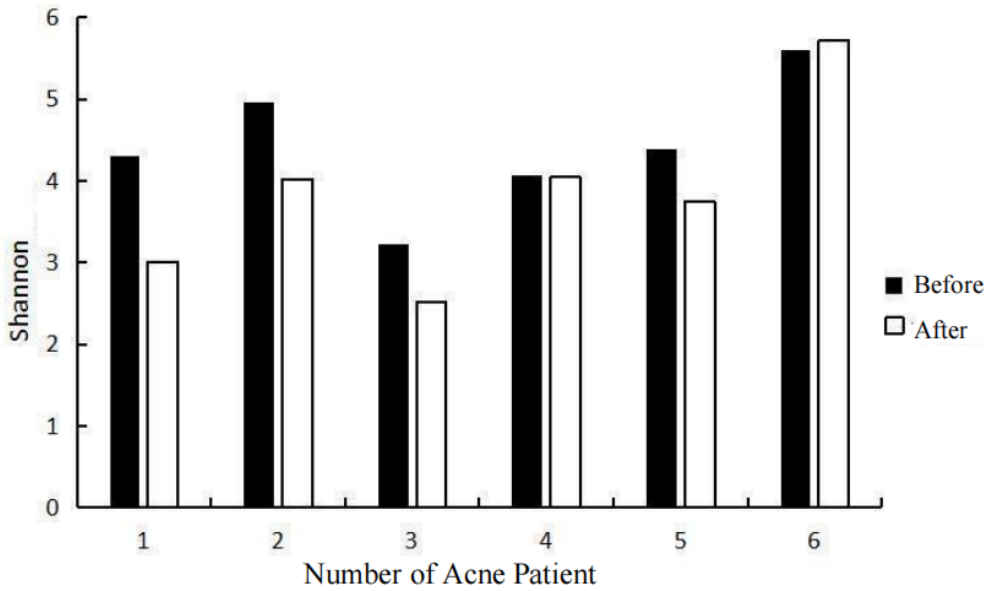


Figure 3-5 Comparison of the Shannon index of the intestinal flora in healthy individuals before and after the anti-inflammatory food treatment

3.3.2 Changes in the Proportion of Intestinal Flora

According to the abundance of intestinal flora before and after the intervention, the change of intestinal flora proportion of the subjects before and after the intervention was evaluated. In this study, the change of intestinal flora proportion of the subjects after the intervention was applied to determine whether golden inulin can inhibit or promote the growth of this bacterial genus.

As indicated by the relative abundance of the microbial flora at the phylum level of subjects before and after the intervention in Figure 3-6, the proportion of proteobacteria among the intestinal flora at the microbiological phylum level of the two groups generally declined. According to the proportion of proteobacteria in the intestinal flora of healthy individuals before and after anti-inflammatory intervention in Table 3-3, three volunteers in the healthy group showed a decrease in the proportion of proteobacteria. Observed from Table 3-4, the proportion of

proteobacteria in the intestinal flora of five volunteers in the acne patient group decreased, and the proportion of proteobacteria in the intestinal biota in the acne patient group showed an overall downward trend due to the intervention of golden inulin.

At the level of microbial genus, the proportion of Dorea bacteria in the volunteers in the two groups showed an overall downward trend after they received the golden inulin intervention, as presented in Table 3-5 and Table 3-6. According to Table 3-7 and Table 3-8, the proportion of Clostridium flora in the two groups showed a decreasing trend after the golden inulin intervention. Specifically, in the healthy group, the proportion of Dorea bacteria in all volunteers decreased, and except for volunteer 1, the proportion of Cloobacterium of other three volunteers decreased or kept unchanged; in the acne patient group, except for the increase in the proportion of Dorea flora in patient 2 and no increase in the proportion of Dorea flora in patient 5, the proportion of Dorea flora in the other patients all decreased, and the proportion of Clostriobacterium intestinal flora in a total of four patients decreased. Therefore, golden inulin inhibits the growth of the genera Cloobacterium and Dorea to a certain extent.

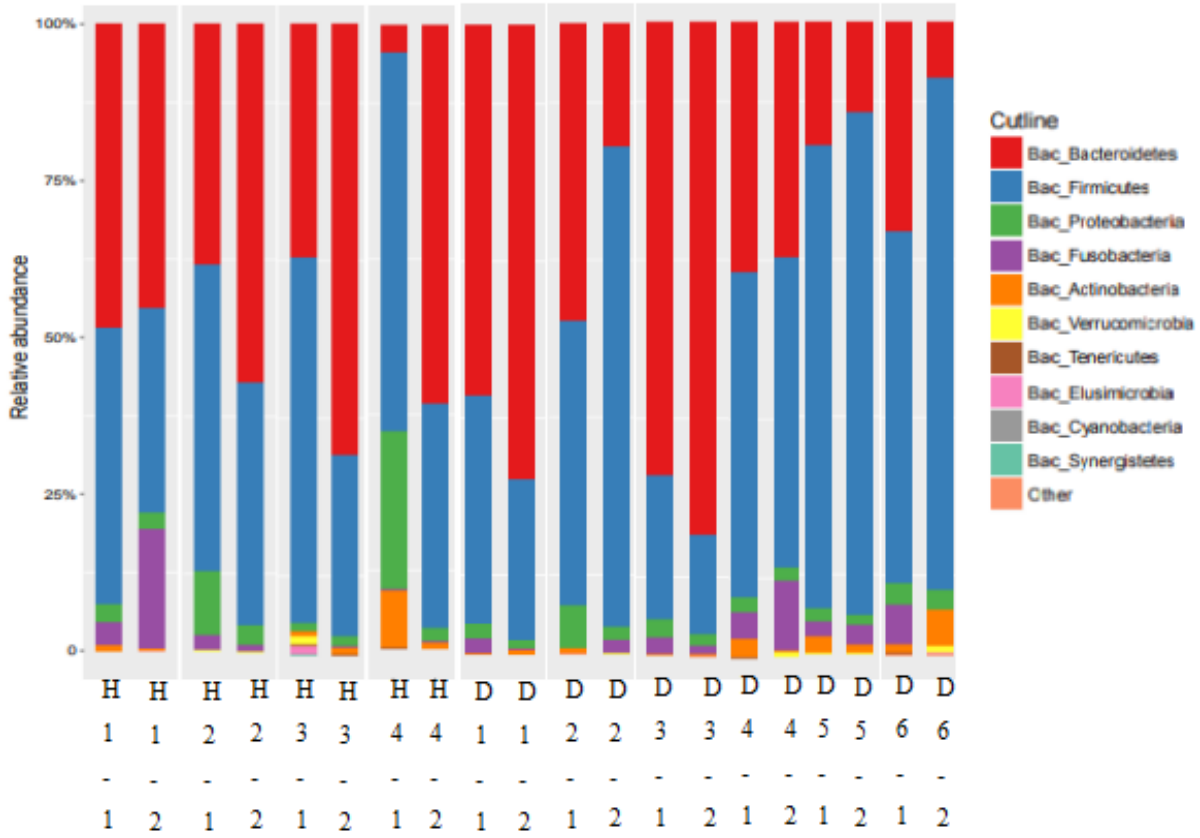


Figure 3-6 Relative abundance of microflora composition at the phylum level before and after the intervention

Table 3-3 The proportion of proteobacteria in intestinal flora in the healthy group before and after the intervention

Volunteers	Before the intervention	After the intervention	Change (down/flat/up)
Healthy volunteer 1	2.80%	2.50%	Descend
Healthy volunteer 2	10.20%	3.20%	Descend
Healthy volunteer 3	1.30%	1.80%	Rise
Healthy volunteer 4	25.50%	2.20%	Descend

Table 3-4 The proportion of proteobacteria in the intestinal flora in the acne patient group before and after the intervention

Volunteers	Before the intervention	After the intervention	Change (down/flat/up)
Acne patient 1	2.20%	1.50%	Descend
Acne patient 2	6.70%	2.20%	Descend
Acne patient 3	2.60%	1.90%	Descend
Acne patient 4	2.20%	2.30%	Rise
Acne patient 5	2.10%	1.70%	Descend
Acne patient 6	3.60%	3.20%	Descend

Table 3-5 The proportion of Dorea in intestinal flora in the healthy group before and after the intervention

Volunteers	Before the intervention	After the intervention	Change (down/flat/up)
Healthy volunteer 1	0.30%	0.10%	Descend
Healthy volunteer 2	0.10%	0.00%	Descend
Healthy volunteer 3	0.40%	0.20%	Descend
Healthy volunteer 4	0.10%	0.00%	Descend

Table 3-6 The proportion of Dorea in the intestinal flora in the acne group before and after the intervention

Volunteers	Before the intervention	After the intervention	Change (down/flat/up)
Acne patient 1	0.60%	0.20%	Descend
Acne patient 2	0.50%	1.00%	Rise
Acne patient 3	0.20%	0.10%	Descend
Acne patient 4	0.40%	0.10%	Descend
Acne patient 5	0.10%	0.10%	Unbiased
Acne patient 6	0.30%	0.10%	Descend

Table 3-7 The proportion of clostridium in the intestinal flora in the healthy group before and after the intervention

Volunteers	Before the intervention	After the intervention	Change (down/flat/up)
Healthy volunteer 1	3.70%	19.10%	Rise
Healthy volunteer 2	2.30%	1.10%	Descend
Healthy volunteer 3	0.00%	0.00%	Unbiased
Healthy volunteer 4	0.10%	0.00%	Descend

Table 3-8 The proportion of clostridium in the intestinal flora in the acne patient group before and after the intervention

Volunteers	Before the intervention	After the intervention	Change (down/flat/up)
Acne patient 1	2.04%	0.00%	Descend
Acne patient 2	2.00%	0.00%	Descend
Acne patient 3	2.08%	1.30%	Descend
Acne patient 4	4.40%	10.90%	Rise
Acne patient 5	2.30%	3.00%	Rise
Acne patient 6	3.20%	0.20%	Descend

4. Discussion

Acne vulgaris is a chronic inflammatory disease of the sebaceous hair follicle glands, the incidence of which in China is 36.0% to 51.3%. Among all acne vulgaris types, severe acne with the lowest cure rate and the easiest recurrence, which accounts for 1.8% to 6.7%%[20, p. 444], can seriously affect the appearance and mental health of patients and cause many social problems[21, p. 367]. It has been found that skin damage severity in adolescent acne patients is significantly associated with their stress[22, p. 180].

At present, acne has affected many teenagers and caused them to suffer serious appearance and psychological distress, especially the more severe recurrence of acne at the affected facial area due to the nonstandard medical cosmetology or the usage of covering cosmetics. One of the most extensively recognized effective acne treatments is isotretinoin therapy, but the cumulative drug treatments are closely related to the recurrence rate of acne. A larger dose helps improve the skin damage quickly, but its adverse reactions will also increase[23, p. 266]. In particular, the potential adverse reactions of oral isotretinoin treatment have been worrying patients.

Meanwhile, more and more studies indicate that the imbalance of intestinal flora may cause skin inflammation, and skin inflammation is often accompanied by changes in the levels of inflammatory factors. Therefore, based on the changes of intestinal flora, the affected facial area status, and the levels of the inflammatory factors of the patients before and after the golden inulin intervention, this study initially explored whether adjusting intestinal flora status through food

taking can help treat acne.

A total of 6 patients with moderate and severe acne were collected as the experimental group while 4 healthy patients were in the control group. All subjects were local college students who volunteered to participate in the experiment. According to the facial photo records and the feedback of volunteers, most of the affected areas of acne patients were relieved, and both groups of subjects had no adverse effects after consuming golden inulin during the experiment. The concentrations of inflammatory cytokines IL-6 and TNF-α in the blood samples collected from each volunteer were detected. The results indicate that the concentration levels decreased in both groups, with the inflammatory indicator of interleukin-6 decreasing by 19.40% to 59.07% in the acne patient group and the tumor necrosis factor decreasing by more than 30% in most of the patients. According to the experimental results, the Shannon index of the intestinal flora of the acne patient group after the anti-inflammatory substance intervention was remarkably different from that before the intervention; that of most of the acne patients showed a downward trend after the golden inulin intervention. After the golden inulin intervention, it was found that the proportion of the intestinal proteobacteria at the level of microphyla of both groups showed a downward trend; at the level microbiological genus, the proportion of Dorea and Cloobacterium decreased to different degrees in both groups.

The ecological imbalance of intestinal flora is an essential factor that determines the health of the human body, i.e. the normal flora structure can promote body health while the flora imbalance will cause the occurrence of

diseases[24, p. 15]. Proteobacteria mostly pathogenic bacteria, studies found that the pathogen infection caused by intestinal inflammation changed the intestinal flora structure, and suggests the possible correlation between the bacteria and inflammatory bowel disease, its growth is thought to cause intestinal flora disorders, intestinal inflammation, the decline of the golden inulin has the effect of improving the intestinal flora, and the effective rate for acne patients is higher. Fusobacterium exists in the upper respiratory tract and the gastrointestinal tract, which can cause serious infection bacteremia and periodontal disease. Previous research indicates that Fusobacterium is associated with oral and digestive tract inflammation and Dorea bacteria can promote the inflammatory effect. These two genera are positively correlated with inflammation promotion, and their significant decline demonstrates that golden inulin imposes a significant inhibitory effect on the bacterial genera in the intestinal flora of the subjects in both groups that have pro-inflammatory effects.

Combined with the changes in the proportion of intestinal flora in the subjects with acne after the golden inulin intervention, the proportion of proteobacteria, Dorea, and Clostridium related to the pro-inflammatory effect in the intestinal tract decreased Therefore, this experimental study believes that the golden inulin intervention might reduce the levels of inflammatory factors in acne patients and relieve their acne symptoms by inhibiting the inflammation of Dorea, the intestinal flora involved in inflammation in acne patients, but the specific mechanism of intestinal flora on acne needs to be further investigated.

Nonetheless, this study has certain deficiencies as follows. First, the number

of subjects was small and they came from the same small living environment. Second, the controllability of the population experiment was poor, and there were intestinal microflora differences among individuals due to their living habits and other reasons. Third, the activities of volunteers were not completely uniform during the experiment, which may lead to experimental deviation. There are still a series of problems like the development of intervention foods that can stabilize and effectively improve the symptoms of acne, which more researchers are expected to explore. Thus, this study can serve as a reference for the design of large-scale experiments on the development of food for acne intervention

5. Conclusions

Through longitudinal comparison of the intestinal microecological changes of acne patients and combined with inflammatory factors levels with healthy volunteers as a control group, this research found that golden chrysanthemum can change acne patients' intestinal flora diversity and reduce the proportion of proinflammatory intestinal flora, thereby lowering the inflammatory factors in acne patients and relieving the acne symptoms. The results of this experiment indicate that the changes of intestinal flora in acne patients might affect the changes of their inflammatory factor levels, hence the incidence of acne can be reduced by improving the structure of human intestinal flora through food treatment. From the perspective of food science, this experiment studied the influence of anti-inflammatory food on the intestinal flora and inflammatory indicators of acne patients for the first time, which provides a reference for future research on food treatment of acne.

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