

The Effects of Natural Material Extracted from Rice Bran on Skin in vivo

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Summary

Inositol and phytic acid extracted from rice bran were investigated for applying cosmetics. Skin lotions containing 0~3.0wt% inositol and 0~1.5wt% phytic acid were applied respectively, to the arm skins of 45 Asian women 20~40's for 7 weeks. Improvement on moisture was evaluated. In addition, improvements on sebum, elasticity, and wrinkle were examined after applying placebo, inositol and phytic acid-containing skin lotions for face, respectively.

For 1.0 wt% inositol resulted in 19% increase of moisture. The wrinkle reduction and elasticity improved 12.4% and 17.0% on average, respectively. Applying 0.5wt% phytic acid resulted in 71.6% increase the moisture. Improvements on wrinkle and elasticity were 15.9% and 21.9% respectively. Applying inositol or phytic acid regardless of dry or oily, resulted in sebum value recovery to that of the normal skin after 2- 4 weeks.

Inositol is inferior to phytic acid in improvements of the skin, and phytic acid is not suitable to sensitive skin. So 0~0.5wt% of phytic acid were added to 1.0wt% inositol and similar experiments were carried out. In case of added 0.1wt% phytic acid, moisture increased 63.8% approximately. Improvements on elasticity and reduction on wrinkle were 17.2% and 17.4%, respectively. Both skin types were turned to normal skin type after 2 weeks. It could improve the skin condition when used inositol added phytic acid. The optimized concentration of phytic acid was 0.10wt% with 1.0wt% of inositol for synergic effect.

1. Introduction

Skin is the most outer layer that surrounds the body which has the ability to protect from exterior stimulations and controls the secretion of the sebaceous gland and the sweat gland [1]. The surface of the skin is covered with sebum membrane in the form of natural emulsion which is made up of fat and moisture [2]. So, sebum and moisture must be sufficiently present to maintain moisturized skin. Without such a natural moisture factor, it can cause dryness in the skin, the keratin layer may get thicker, and it can cause aging of the skin. Aging causes not only decrease in cellular reproduction ability of skin but also decrease in transformation of fat cell and bonding force between elastin fibrous tissues. Consequently, skin wrinkles and loses its

elasticity. Therefore, functional cosmetics can often be used to delay the aging of skin by maintaining the appropriate amounts of moisture and sebum and to provide skin elasticity.

The nature ingredients such as collagen, hyaluronic acid, elastin etc, are good for moisture capacity of skin but they are expensive so there are some restrictions on the application. Some experiments have been reported recently which new environmental ingredients for cosmetic components can be applied. Inositol and phytic acid are known as new environmental ingredients. Inositol, which belongs to the vitamin B group, extracted from rice and is a water soluble crystalline compound with a sweet taste. Depending on the location of the OH radical, the inositol is able to have 9 different isomers. Among these, myo-inositol has the most biological activity and is found the most in nature [3,4]. With the experiments it has found that inositol has the effects on restraining cancer, decreasing cholesterols, metabolism, and preventing baldness. Phytic acid extracted from rice bran has been known as an antioxidant in delaying skin aging by inhibiting formation of hydroxyl radicals [5,6]. The effect of anticancer reduces hepatic tumors and bladder tumors and its inhibition effect in fat increase within the blood are also known [7-9]. Due to such effects, phytic acid has wide applications in food, medicine, and pharmaceutical industries [10,11]. Inositol is a good ingredient for skin with low skin-stress but has a little effect on skin improvement. So, there is difficult to have good effect by inositol alone. Phytic acid shows high activities but the use of much pH controls using causes in skin stress.

Therefore, the purpose of this study is to find out that, using the inositol and phytic acid which show similar structures and have mutual effects, feasibility of inositol and phytic acid as a new functional ingredients in cosmetics is examined. Skin lotions containing inositol and phytic acid were prepared, applied on skin, and its effects on moisture, sebum, elasticity, and wrinkling of skin were evaluated.

2. Experiments

2.1. Materials

Inositol and phytic acid were purchased from Tsuno Rice Co., LTD (Japan). Other reagents were also purchased from commercial sources as follows: glycerin, ethanol, and potassium hydroxide from Duksan Pure Chemical Co., LTD (Korea), disodium ethylene diaminetetraacetic acid (EDTA-2Na) from Fushimi Chemical, Co. (Japan), allantoin from Aktiengesellschaft Frankfurt (Germany), hyaluronic acid from Aldrich Chemical (USA), imidazolidinyl urea (Germall 115) from Sutton laboratories (USA), methyl paraben (para-M) from Nipa Laboratories (Japan) and cremophor RH-60 from BASF (Germany). All the reagents were analytical grade and the water distilled twice was used throughout the study.

2.2. Methods

2.2.1. Preparation of Skin Lotion

Inositol(1wt%) and different concentrations of phytic acid (0.05, 0.10, 0.15, and 0.20wt%), 0.2wt% allantoin, 0.05wt% EDTA-2Na, 0.1wt% germall, and 8.0wt% glycerin were successively added in a beaker containing 80 wt% distilled water. An agitation mixer was used to obtain a homogeneous solution. The pH of the solution was controlled to 4-4.5 by using an aqueous KOH solution. A mixed solution of 0.4wt% cremophor RH-60, which was dissolved at 60°C, and 0.08wt% perfume was added in a pre-made solution of 8.0wt% ethanol and 0.1wt% para-M followed by a complete stirring. This mixed solution was again blended with the inositol and the phytic acid solution and stirred for 2 minutes. The inositol and phytic acid skin lotion were finally prepared by adding 1.0wt% hyaluronic acid in the mixed solution followed by balancing with distilled water to make into 100wt%. The skin lotions were immediately stored in an airtight container at room temperature.

2.2.2. Organization and Restriction of Subjects

Subjects used were 15 healthy Asian women (20's-30's and 40's-50's). Eleven of them had dry skin and others had oily skin. The inositol and phytic acid skin lotions with various concentrations were applied each morning and evening after washing for seven weeks on specific area of face, cheek, and arm of the subjects. Moisture effect on arm was measured after applying the inositol(1wt%) and phytic acid(0.05, 0.10, 0.15, and 0.20wt%) skin lotion. Sebum, elasticity, and wrinkle of skin were evaluated after applying the inositol(1wt%) and phytic acid(0.1wt%) skin lotions on specific area of the subject's face.

2.2.3. Moisture Measurement

The inositol(1wt%) and phytic acid(0.05, 0.10, 0.15, and 0.20wt%) skin lotions were evenly applied on the specific areas of the subject's both arms twice a day. The subjects were located in a constant temperature and humidity room for 20 minutes prior to moisture evaluation to minimize effect of atmospheric conditions on the measurement. Corneometer(CM820PC, Courage + Khazaka, Germany) was used to measure the moisture.

2.2.4. Sebum Measurement

The sebum was evaluated by measuring sebum concentration secreted in sebum gland. The inositol(1.0wt%) and phytic acid(0.1wt%) skin lotions were applied on each side from the middle of the face twice a day in morning and evening after washing. The measurements were made on center of forehead and cheek area located 2cm below the subject's eye. Sebumeter(SM80, Courage + Khazaka, Germany) was used.

2.2.5. Elasticity Measurement

The skin elasticity was measured before and after applying the inositol(1.0wt%) and phytic acid(0.1wt%) skin lotions on the specific area of the subject's face twice a day. The measurement was carried out 30 minutes after applying the skin lotion on cheek area located 5cm below the subject's eye. The measurement was made each week during a period of seven weeks by using Cutometer (SEM474, Courage + Khazaka, Germany) with three replications.

2.2.6. Wrinkle Measurement

To measure wrinkles of the skin, replicas were traced from areas located 1cm below the subject's both eyes prior to any application of the skin lotion. The skin lotion without inositol and phytic acid was applied on the area below the left eye and the skin lotions with inositol(1.0wt%) and phytic acid(0.1wt%) were applied on the area below the right eye twice a day. After seven weeks' application of the lotion, the replicas were retraced and analyzed by Image Analyzer (KIT-500, PIAS, Japan). Effects of the skin lotion on number, depth, length, and width of the wrinkles were quantitatively analyzed [12].

3. Results and Discussion

3.1. Effects on the Skin Moisture

If skin is exposed to the outside without a protection layer, the vaporization of the moisture from the stratum corneum becomes easy and the moisture quantity decreases suddenly [13,14]. For healthy skin, it is important to maintain a balance between skin's moisture and sebum on the skin and to maintain moisturized skin.

Figure 1 shows the amount of moisture after applying the placebo and inositol(1.0wt%)-phytic acid(0.05, 0.1, 0.15, 0.2wt%) skin lotions on the specific area of the subject's arm for seven weeks. In the placebo, little change occurred in the moisture value from the initial average moisture value of 59.24 to 59.15 after seven weeks. On the other hand, in the inositol-phytic acid skin lotions, the moisture value increased continuously from 56.81 to above 90 for seven weeks. With the inositol(1.0wt%)-phytic acid(0.05wt%) skin lotion, the moisture value increased from 56.81 and held 85.00 after five weeks. In the inositol(1.0wt%)-phytic acid(0.10, 0.15, 0.20wt%) skin lotion, the moisture value started to increase from 56.81 and its value held more 90 after three weeks. According to the results, there was a slight difference between the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotion and the other skin lotions. By three weeks application of the inositol(1.0wt%)-phytic acid(0.10, 0.15, 0.20wt%) the moisture value of skin could be improved to normal skin area. Therefore it can be explained that the effective concentration of phytic acid can be said to be a value of 0.1wt%.

To compare the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotion to the inositol(1.0wt%) and phytic acid(0.5wt%) skin lotions, the amount of moisture on the specific area of the subject's arm for seven weeks after applying the skin lotions were illustrated with the increasing rate of moisture in Figure 2. In the placebo, little change occurred in the moisture value. With the

inositol(1.0wt%) skin lotion, the initial moisture value was 65, its value was 72.3 after one week, 76.0 after two weeks, and after four weeks its value maintained 77.70 constantly. The increase of moisture revealed 19%. With the phytic acid(0.5wt%) skin lotion the initial moisture value was 54 and its value increased continuously to 70, 83, and 86 for one week, two weeks, and three weeks, respectively, and then after four week a value of 92 held constantly. And the increase of moisture was 71.6%. With the inositol(1wt%)-phytic acid(0.1wt%) skin lotion, similar to the case of the phytic acid(0.5wt%) skin lotion, its value increased continuously to three weeks ; 76.40 after one week and 88.75 after two weeks and at a value of 93.08 after three weeks its value leveled off, and the increasing rate of moisture revealed a value of 63.08%. The higher value in the moisture by the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotion was the following reasons; Inositol and moisture substances penetrating the stratum corneum or through the eccrine sweat gland and pores, partly absorbed into the skin directly allowed the moisture to be supplied smoothly and keep the appropriate amount of moisture in the skin[15-22]. And phytic acid bonded the moisture could readily mix with various proteins in stratum corneum and intercellular molecules, and resulted in increased amount of bound water. Consequently, it can be explained that such effects imparted moisture-holding ability of stratum corneum [2,23]. With such a synergic effects of the inositol and phytic acid, the OH radicals of unabsorbed the inositol and phytic acid into the skin acted as a sponge to delay the sudden moisture vaporization[24].

3.2. Effects on the Skin Sebum

Sebum is a natural sebum membrane which has an effect on skin protection and the aging of skin. It is made up of the soil secreted from the pores as well as cholesterol, squalene, and medium chain lipid. If more sebum than is needed is secreted from the pores, it is easy to get infected of bacteria. If there is little secretion, the formation of the natural sebum membrane gets difficult. So the skin may be attacked by the penetration of bacteria from the open air. Therefore, to protect the skin-aging and bacteria penetration, it is needed to have an appropriate amount of sebum on the surface of skin. It has been reported by dermatology that the appropriate amount of sebum is 105-125 $\mu\text{g}/\text{cm}^2$ for the neutral skin. In this study, sebum values of the subjects were widely varied from 22 $\mu\text{g}/\text{cm}^2$ to 222 $\mu\text{g}/\text{cm}^2$ before the application of any skin lotions. Therefore, the subjects' skin with the sebum values below or equal to 80 $\mu\text{g}/\text{cm}^2$ was designated as dry skin, the skin with the sebum values above or equal to 150 $\mu\text{g}/\text{cm}^2$ were assigned as oily skin. The sebum values were evaluated for the placebo, inositol(1.0wt%), phytic acid(0.5wt%), and inositol(1.0wt%)-phytic acid(0.1wt%) skin lotions, respectively.

Figure 3 shows the increasing rate of sebum values for dry skins of the subjects after applying the skin lotions for seven weeks. Before applying the skin lotions, the initial sebum value was 38 $\mu\text{g}/\text{cm}^2$. In the application of the placebo, the increasing rate of sebum value were nearly 2.3%, hence it can be said that little change occurred in the sebum value for seven weeks. However in the case of the inositol(1.0wt%), the phytic acid(0.5wt%), and the inositol(1.0wt%)-

phytic acid(0.1wt%) skin lotions, the increasing rate of sebum value started to increase after initial measurements and sharply increased to 170 - 200% on average for four weeks. And then its value did not show the further increasment. After four weeks the sebum values were 114, 105, and 113.7 $\mu\text{g}/\text{cm}^2$ for the inositol(1.0wt%), the phytic acid(0.5wt%), and the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotions, respectively. With these results it took 4 weeks more for the improvement of skin by the inositol(1.0wt%) and phytic acid(0.5wt%) skin lotions, but in case of the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotion, only 2 weeks were needed. Hence, for the improvement of skin the using with inositol and phytic acid simultaneously could take less time for the improvement of skin than that of inositol and phytic acid, individually.

Figure 4 shows the decreasing rate of sebum values of oily skins of the subjects after applying the skin lotions for seven weeks. The sebum values of the oily skins of the subjects varied to 220 $\mu\text{g}/\text{cm}^2$ from 170 $\mu\text{g}/\text{cm}^2$ before the application of any skin lotions. Similar to Figure 3, in the case of the placebo skin lotion little change occurred in the sebum value (from 194.6 $\mu\text{g}/\text{cm}^2$ to 179.1 $\mu\text{g}/\text{cm}^2$). On the other hand, the decreasing rate for the inositol(1.0wt%) and the phytic acid(0.5wt%) skin lotions sharply increased to 30-40% on average for four weeks, and then revealed no further increase. That is; the sebum value decreased from 195 to 125 and 130 $\mu\text{g}/\text{cm}^2$, respectively. However in the case of the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotion, the decreasing rate significantly increased to 40% for only two weeks. That is; the sebum value decreased from 196 to 117.4 $\mu\text{g}/\text{cm}^2$, and then kept constant. Similar to the results of Figure 3, it took four weeks for the improvement of skin by the inoitol(1.0wt%) and phytic acid(0.5wt%) skin lotions but incase of the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotion, only two weeks were needed. Hence for the improvement of skin, the using with inositol and phytic acid simultaneously showed more effective than that of the inositol and phytic acid, individually. According to the results of Figures 3 and 4, the using of the inositol(1.0wt%)-phytic acid (0.1wt%) could effectively changed the sebum values of dry and skin to the value between 100 $\mu\text{g}/\text{cm}^2$ and 130 $\mu\text{g}/\text{cm}^2$, which is very close to the sebum value of neutral skin. This means that the absorbed inositol maintained the appropriate amount of cholesterol which was secreted from the sebum gland in the pore, and the absorbed phytic acid combined with radical oxygen so it hindered the destruction of the stratum corneum[25-29].

3.3. Effects on the Skin Elasticity

The combined effects of moisture, sebum, and connective tissue affect on the elasticity of skin. As time passes, the reproductive ability of skin cells decreases, transformation of hypodermis occurs, and elastin fibrous tissue bonds are weakened. Connective tissue is composed of cellular group, such as fibroblast, collagen, stellate cells, and gel-like intercellular compositions containing elastin, collagen, and network structure. It is also connected to hypodermis-apipose tissue [30]. The elasticity of skin was evaluated when elasticity of a fully air-blown balloon was

assigned as 1. And in our experiments the elasticity of skin was divided into two groups; 20's-30's subjects and 40's-50's subjects.

The values of skin elasticity were evaluated for the placebo, inositol(1.0wt%), phytic acid(0.5wt%), and inositol(1.0wt%)-phytic acid(0.1wt%) skin lotions for seven weeks.

Figure 5 shows the increasing rate of skin elasticity on the face of the 20's-30's subjects after applying the skin lotions. As can be seen, in the placebo there was no substantial difference in the skin elasticity; its value was 0.132 on average before the application and 0.135 after seven weeks. That is ; the increasing rate revealed only a value of 2-3%.

However the increasing rate of skin elasticity increased gradually to 2-3weeks and then held constantly. In the case of the inositol(1.0wt%) skin lotion the elastic values of skin were 0.147, 0.148, and 0.158 for 1, 2, and 3 weeks, respectively, and then after three weeks the increasing rate revealed a value of 9%. In the case of the phytic acid(0.5wt%) skin lotion the elastic values of skin were 0.137, 0.134, and 0.147 for 1, 2, and 3 weeks, respectively, and then after 3weeks the increasing rate showed a value of 13%. However, with the inositol(1.0wt%)-phytic acid(0.1wt%) its value were 0.139 and 0.155 for 1 and 2 weeks, respectively, and then after 2 weeks the increasing rate revealed a value of 18%.

Figure 6 shows the increasing rate of skin elasticity on the face of the 40's-50's subjects after applying the skin lotions. In the placebo, the skin elasticity varied from 0.113 to 0.119 for seven weeks. Hence, it may be explained that there was nearly any change in the skin elasticity as time passed. As can be seen, similar to the results of Figure 5 the increasing rate increased gradually to 4 weeks and then held constantly. With the inositol(1.0wt%) skin lotion, the initial value of skin elasticity were 0.116 and its values were 0.131, 0.124, and 0.136 for 1, 2, and 4 weeks, respectively. The skin elasticity improved about 17.0%. In the case of the phytic acid(0.5wt%) skin lotion although its initial value was low 0.102, after one week its value continuously increased to 0.120, 0.123. And after four weeks the increase rate of elasticity revealed a value of 21%. With the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotion the initial value of skin elasticity was 0.115 and its value were 0.113, 0.122, and 0.135 for 1, 2, and 4 weeks, respectively. And the increasing rate revealed similar to that of inositol, and its value was 17.2%. With the results of Figures 5 and 6, it can be concluded that the needed time of improvement of skin elasticity for the 20's-30's subjects is shorter than that of the 40's-50's subjects, because the 40's-50's subjects were more age-hardening. And the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotion is more effective than the inositol and phytic acid skin lotion, and the effectiveness of the 40's-50's subjects are much greater than that of the 20's-30's subjects. These results suggest that all of inositol and phytic acid enhance the activities of the aged skin. The inositol softened the adipose cell into a gel like condition, and increased the flow the capillary vessel to easily deliver the cell nutrition and to reproduce the reticular cells to improve the skin elasticity. Phytic acid bonded the cell reproduction, collagen, the moisture of elastine, and then especially acts as the antioxidation of the aged cell because the aging of the 40's-50's

subjects more progressed than that of the 20's-30's subjects. Therefore it can be explained that the elasticity of skin can be increased by the synergic effect of the inositol and phytic acid[31-33].

3.4. Effects on the Skin Wrinkles

As the aging progresses, keratinization cycle becomes longer and stratum corneum becomes thicker and the amount of moisture of the stratum corneum decreases, which makes skin dry. If the skin gets dry skin, the bond between collagen and elastin cells weakens and fine wrinkles increase. In addition, blood circulation speed of existing capillary vessels in the dermic layer gets slow down so the delivery of oxygen and nutrients decreases, which results in unhealthy skin cells [34, 35]. The datas on the degree of total improvement in wrinkles after applying the placebo, the inositol(1.0wt%), the phytic acid(0.5wt%), and the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotions are listed in Table 1, 2, 3, and 4, respectively. Evaluation parameters on skin wrinkles were peak (number of wrinkles), length, depth, and width. Total wrinkle improvement value was obtained by calculating combining effects of four parameters, such as peak, length, depth, and width of wrinkles, with putting the different weight on the factor; 30% for peak; 20% for length; 30% for depth; 20% for width, respectively.

As shown in Table 1, with the application of the placebo skin lotion, the individual improvements of peak, length, depth, and width were 1.8%, -0.1%, 0.6%, and -2.5% on average, respectively, and the total improvement was 0.2. Hence, according to these data it may illustrate that the placebo skin lotion showed no substantial increase in wrinkle improvement.

In Table 2, with the application of the inositol(1.0wt%) skin lotion, the individual improvement of peak, length, depth, and width were 8.2%, 17%, 14.5%, and 11.3%, respectively, the values of length, depth, and width are much more higher than that of peak. Although there was a wide difference in the individual improvement according to the subjects like as in Table 1, the total improvement were 12.5%, which illustrates much greater improvement in wrinkle than that of the placebo skin lotion.

In Table 3, with the application of the phytic acid(0.5wt%) skin lotion, the improvement of peak, length, depth, and width were 9.7%, 19.1%, 18.8%, and 17.8%, respectively. And the value of length, depth, and width were much higher than that of peak too like as in Table 2. However, compared to Table 2 the differences in the individual improvement according to the subjects reveal small. The total improvement was 15.9%, which also illustrates much greater improvement in wrinkle than that of the inositol(1.0wt%) skin lotion.

In Table 4, with the application of the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotion, the improvement of peak, length, depth, and width were 19.7%, 16.6%, 17.7%, and 14.4%, respectively. Its four parameters of wrinkle were almost same in each other, and the individual improvement showed evenly for all the subjects. And the total improvement was 17.4%.

With the results in Table 2, 3, and 4, it may be concluded that the use of the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotion is more beneficial than that of the placebo, the inositol(1.0wt%), and the

phytic acid(0.5wt%) skin lotions on the wrinkle improvement, and especially shows more effectiveness in the peak. These results can be explained mainly by the combining effects on the moisture, sebum and elasticity by the synergic effect of the inositol and phytic acid.

4. Conclusions

In this study of the effects on the moisture, sebum, elasticity, and wrinkle of skin with the use of inositol and phytic acid skin lotions, the following conclusions were obtained.

1. The moisture values were 66.9, 92.7, and 93.0 for the inositol(1.0wt%), the phytic acid(0.5wt%), and the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotion, respectively. The increasing rates of moisture were 19%, 71.6%, and 63.8%, respectively.

2. In the sebum value, the time needed for the dry or oily skin to be changed into the neutral skin were 4 weeks and 2 weeks for the inositol(1.0wt%) and phytic acid(0.5wt%) skin lotion, and the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotion, respectively.

3. The improvements of skin elasticity on 20'-30' ages were 9%, 13%, and 18% for the inositol(1.0wt%), the phytic acid(0.5wt%), and the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotions, respectively. Its values on 40'-50' ages were 17.0%, 21.9%, and 17.2%, respectively.

4. The total improvement on the peak, length, depth, and width were 12.5%, 15.9%, and 17.4% for the inositol(1.0wt%), the phytic acid(0.5wt%), and the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotion, respectively.

With the foregoing results, since the problems on using the phytic acid only can be reduced, it can be concluded that, with using the inositol and phytic acid simultaneously, the inositol(1.0wt%)-phytic acid(0.1wt%) skin lotion is more beneficial than any other skin lotions in our experiments. Therefore it can be explained that the inositol and phytic acid are the effective ingredients for cosmetics.

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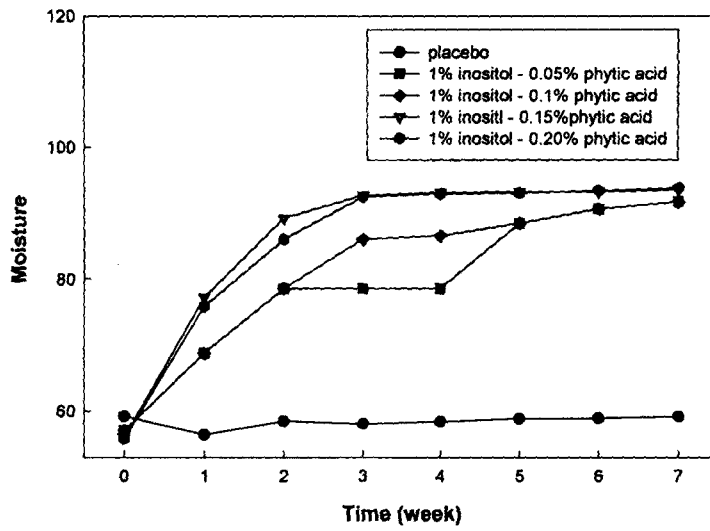


Figure 1. Moisture values after applying the each concentration of inositol and phytic acid skin lotions for seven weeks.

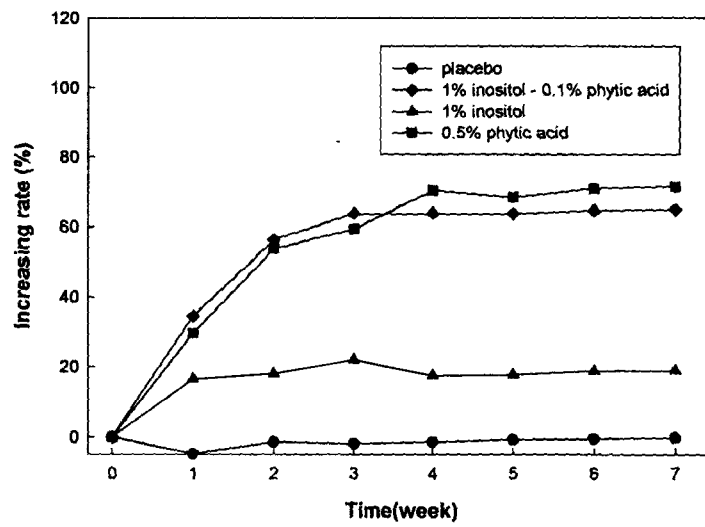


Figure 2. Increasing rate of moisture after applying the inositol, the phytic acid, and the inositol-phytic skin lotions for seven weeks.

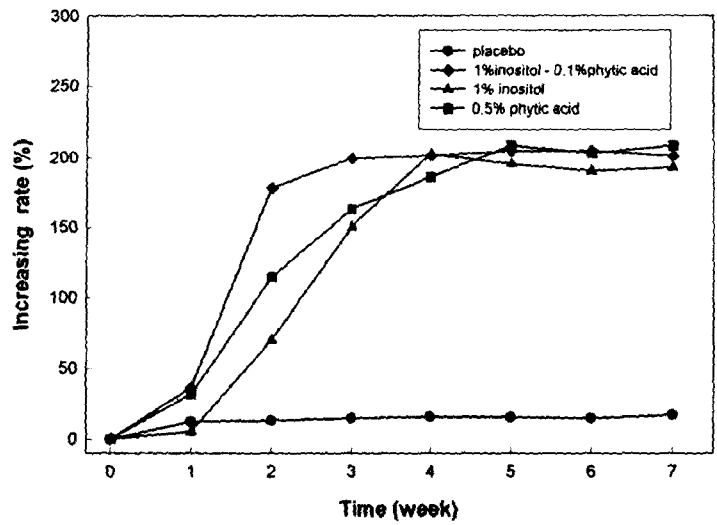


Figure 3. Increasing rate of sebum for dry skins after applying the inositol, the phytic acid, and the inositol - phytic acid skin lotions for seven weeks.

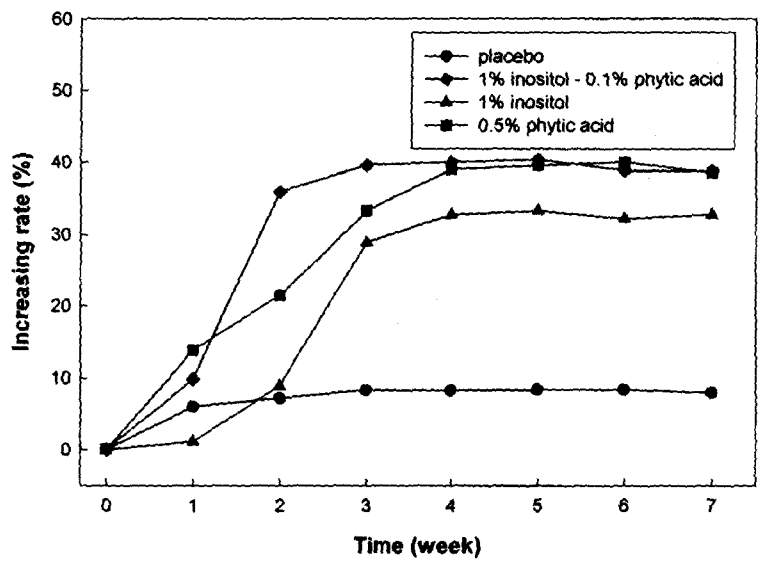


Figure 4. Increasing rate of sebum for oily skins after applying the inositol, the phytic acid, and the inositol - phytic acid skin lotions for seven weeks.

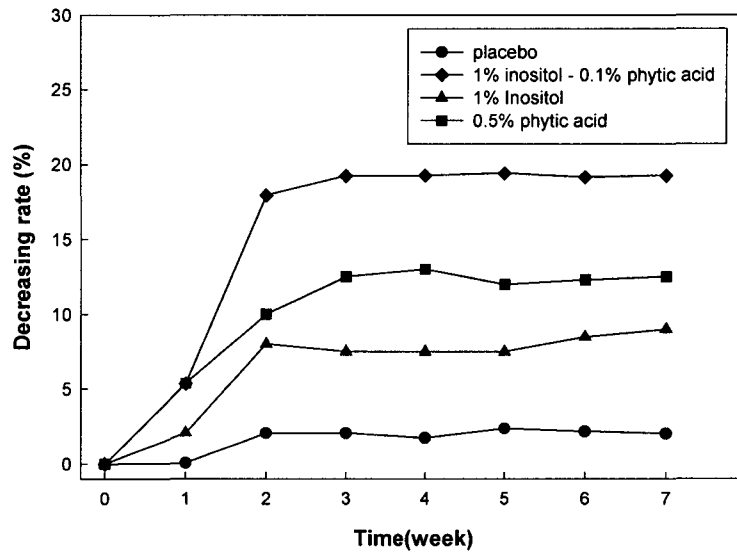


Figure 5. Increasing rate of skin elasticity for 20'-30' ages after applying the inositol, the phytic acid, and the inositol - phytic acid skin lotions for seven weeks.

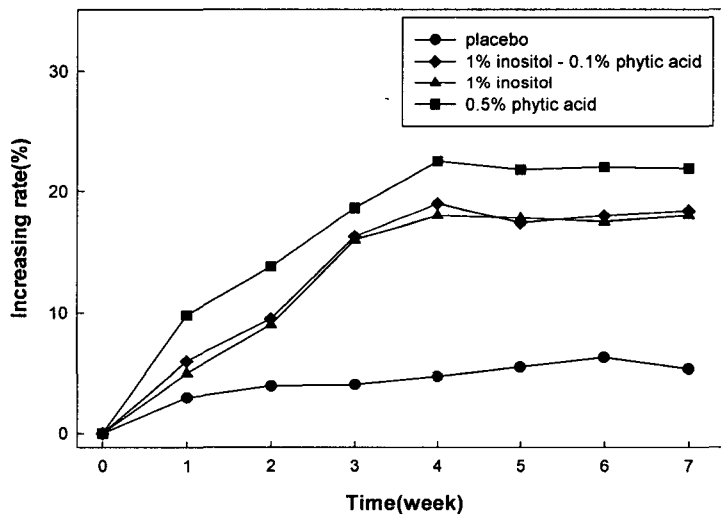


Figure 6. Increasing rate of skin elasticity for 40'-50' ages after applying the inositol, the phytic acid, and the inositol - phytic acid skin lotions for seven weeks.

Table 1. Degree of total improvement in wrinkles after applying the placebo skin lotion for seven weeks

Vol.	Peak	Length	Depth	Width	Total
1	2.9	1.9	0.6	1.0	1.6
2	-2.8	-1.1	-1.8	-3.1	-2.2
3	-4.9	-0.3	4.3	3.4	0.4
4	5.7	-9.8	-2.8	-5.9	-2.3
5	2.5	5.4	0.4	-6.1	0.7
6	2.6	-0.6	-1.6	-2.6	-0.3
7	2.8	3.4	1.1	-2.9	1.3
8	2.2	2.8	5.1	-18.5	-1.0
9	2.3	-1.4	-3.7	25.2	4.3
10	-2.5	4.4	-8.6	0.8	-2.3
11	2.8	-4.4	6.0	7.9	3.3
12	5.9	0.9	10.7	2.0	5.6
13	4.4	-2.7	1.8	-23.1	-3.3
14	-2.3	-6.2	-3.0	-5.2	-3.9
15	5.3	6.4	1.1	-10.9	1.0
Avg.	1.8	-0.1	0.6	-2.5	0.2

Table 2. Degree of total improvement in wrinkles after applying the inositol(1.0wt%) skin lotions for seven weeks

Vol.	Peak	Length	Depth	Width	Total
1	5.4	5.7	-0.5	8.0	4.2
2	9.5	33.3	26.8	9.9	19.5
3	6.5	39.2	35.4	8.3	22.1
4	12.5	9.7	0.0	13.3	8.4
5	20.9	33.6	38.0	25.2	29.4
6	7.7	0.8	-6.3	8.3	2.2
7	12.2	5.2	-7.6	16.3	5.7
8	8.9	30.3	30.1	9.6	19.7
9	0.0	0.7	17.5	-2.0	5.0
10	5.3	0.0	-4.4	3.7	1.0
11	19.4	28.6	15.1	26.6	21.4
12	-8.3	32.7	38.0	2.1	15.9
13	5.3	0.7	5.9	10.7	6.5
14	23.1	32.8	13.8	36.4	24.9
15	-5.4	1.5	12.1	-6.5	1.0
Avg.	8.2	17	14.5	11.3	12.5

Table 3. Degree of total improvement in wrinkles after applying the phytic acid(0.5wt%) skin lotion for seven weeks

Vol.	Peak	Length	Depth	Width	Total
1	-8.3	5.6	15.5	26.5	8.6
2	21.6	32.8	13.4	33.3	23.7
3	5.3	0.7	18.9	14.1	10.2
4	-5.6	32.7	39.9	14.1	19.7
5	19.4	28.6	18.7	26.6	22.5
6	10.3	3.8	7.2	9.3	7.9
7	2.9	0.7	16.5	-2.0	5.6
8	8.9	30.2	31.6	21.0	22.4
9	12.2	27.7	-7.2	22.8	11.6
10	7.7	0.3	9.3	11.7	7.5
11	23.3	33.6	39.0	39.3	33.3
12	12.5	10.3	13.9	11.7	12.3
13	10.6	39.2	33.1	6.5	22.3
14	14.6	32.8	32.5	19.5	24.6
15	10.5	7.7	0.0	12.7	7.2
Avg.	9.7	19.1	18.8	17.8	15.9

Table 4. Degree of total improvement in wrinkles after applying the inositol(1.0wt%)-phytic acid (0.1wt%) skin lotion for seven weeks

Vol.	Peak	Length	Depth	Width	Total
1	15.6	10.8	19.4	12.6	15.2
2	18.4	16.5	17.3	13.8	16.8
3	22.7	20.6	20.6	15.6	20.2
4	14.7	12.8	15.4	13.6	14.3
5	17.3	18.0	16.4	13.4	16.4
6	18.7	11.0	15.7	12.3	15.0
7	24.3	17.4	26.0	19.4	22.5
8	15.4	12.6	12.1	10.2	12.8
9	16.3	14.2	18.4	15.3	16.3
10	26.6	22.5	22.4	11.8	21.6
11	24.3	18.8	17.1	25.2	21.2
12	27.8	31.8	17.3	11.5	22.2
13	17.5	14.5	13.8	14.1	15.1
14	21.8	11.7	13.8	12.5	15.5
15	13.5	15.8	20.4	15.3	16.4
Avg.	19.7	16.6	17.7	14.4	17.4