Effects of Bath Product Named as Sake Concentrate Preparation

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日本酒濃縮浴剤の効果

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抄 録

日本酒濃縮物（日本酒濃縮入浴剤）添加温水が人体にどのように影響をもたらし、有用な作用があるかをみるために、健常成人を対象に日本酒濃縮物添加温水、またその特異成分であるα-エチルグルコシド添加温水、水道水温水と比較検討した。

その結果、血圧・脈拍が3者間で差がなく心肺への負担は水道水温水と同じであった。前額部の表面皮膚温で日本酒濃縮物添加温水が他2者に比して出浴後緩徐な低下であり、保温効果が示唆された。

深部体温計の経過から日本酒濃縮物添加温水が、熱吸収効率の高い要因としてα-エチルグルコン酸の関与が考えられた。

皮膚血流量増加が加味した結果から、日本酒濃縮物添加温水は、温水中の熱が身体内に入りやすく、かつ出にくい環境を作り出すと考えられる。その要素として、α-エチルグルコシド溶存物質が関与することで、より強い熟発作用と保温作用をもつと結論した。

皮膚水分の測定から、温水中に入っている部分では、出浴後早期の潤いはあるが、早期に以前の状態に戻ることがわかった。温水中に入っている表面は、皮膚の角層水分量が日本酒濃縮物添加温水の方が良好であり、保湿性が増加していることが認められた。

Key words : sake α-ethylglucoside bathing, heat transfer, skin moisturizing
I INTRODUCTION

It has been well recognized that sake (rice wine) bathing is valuable for human body. So, Japanese people have occasionally taken sake bathing from old times. Here, an investigation was made on efficacy of a bathing containing a bath product named as sake concentrate preparation (SCP). Effects of SCP bathing on human body were compared with those of α-ethylglucoside (α-EG)-containing bathing. This compound is known as a sake-specific ingredient and 4th major component, which has been regarded to be usable for prevention of rough skin\(^1\). Physiological effects of such bathing were compared with those of tap water bathing, as the control bathing.

II METHODS

Each 200 ℓ of hot tap water alone and tap water added with SCP or α-EG, a specific ingredient of sake was used for bathing. The temperatures of bath and bathroom were kept at 40°C and 25°C, respectively. Measurement was conducted for 5 min in resting condition after sitting for 10 min or more as the pre-bathing measurement. Then, the subject took a bathing at sitting position for 15 min, where the body was immersed in hot water up to the nipple line. Post-bathing measurement was carried out at sitting position. Blood pressure and pulse rate for 2 min were determined. Body temperature measurement for 1 min was made at two sites, forehead and left shoulder using surface skin thermometer and precordia by deep thermometer (Deep Thermo-Monitor, Coatemp CTM205: TERUMO). Blood flows in the skin of dorsal hand, which was not contacting the bath and a dorsal foot, which was directly contacting with bath were measured by laser blood flow meter (ADVANCE AFL-21) as shown in Fig.1. In addition, high-frequency conductance was determined at the cor-

![Fig.1 Measurement during bathing; surface skin thermometer, deep thermometer and laser blood flow meter.](image-url)
neal layer of epidermis before, 10, 20 and 30 min after bathing by skin corneal water analyzer (IBS SKICON-200EX) and the degree of moisturizing in the corneal layer (Fig.2) was evaluated.

III SUBJECTS

Ten healthy adults (each 5 males and females) at the mean age of 21.7±1.2 years were used as the subjects. Each bathing test was carried out with an interval of 5 days or more. The subjects had a bathing without knowing the kind of bath water.

IV MATERIALS

Concentrate of sake (SC, 200gr) was concentrated from 4000ml of commercial source rice wine (produced by Ozeki Corporation, Nishinomiya, Japan) under reduced pressure. SCP prepared from SC to remove D-glucose with α-glucoseoxidase and ion-exchange resin, due to improve sticky-feel of SC. α-EG was prepared by the method reported previously.

V RESULTS

1. Time-course changes in blood pressure and pulse rate (Fig.3 and Fig.4)

Systolic pressure decreased from 120 mmHg to 98 mmHg by about 22 mmHg during a bathing and returned to the baseline in several minutes after taking a bath. Whereas diastolic pressure decreased from 80 mmHg by about 20 mmHg within several minutes of bathing and further decreased...
to 50 mmHg by about 30 mmHg. However, the blood pressure returned to the baseline within a few minutes after taking a bath. There were no significant differences in diastolic pressure changes among them. The pulse rate was 72/min before bathing and gradually increased to 87/min nearly by 15/min after bathing. These were not any significantly differences among the three bathings. The subjects had no complaints of heart and lung disorder like palpitation, short of breath.

2. Time-course changes in surface body temperature

The skin temperature change of both shoulder and forehead were limited 1°C during measurements. Since surface and deep temperatures of volunteers before examinations were distributed widely, the temperature increments from initial temperature were indicated and the change of surface skin temperatures at the forehead and left shoulder were shown in Fig.5 and Fig.6. For three different bathings, it was observed that the skin temperature on left shoulder hardly changed till 9 min after soaking in the bath-tab and increased rapidly up after that. At SCP bathing, forehead temperature was risen up more rapidly and retained more than the other two.
3. Time-course changes in deep body temperature

Temperature in deep body at the left prothoracic region was significantly up at SCP and especially α-EG bathings than tap water bathing. During 15min their bathing, the temperature were up to 0.8 ~1.0°C from the initial. Although the temperature was decreased gradually after bathings, SCP and α-EG were keep longer than tap water (Fig.7).

4. Time course changes in skin blood flow

Blood flows in the skin of dorsal hand that don’t contact with hot water directly and the dorsal foot that contacting with bath water were shown in Fig.8 and Fig.9. The skin blood flow at the dorsal foot started to increase immediately after taking a bath and the increase was more marked in order of SCP, α-EG and tap water. The blood flow increase was prolonged for 15 min. On the other hand, the blood flow in dorsal foot after bathing was not different among the three bathings. Whereas, the blood flow increased in the dorsal hand by any bathing of them, but the increase was not different among them. The blood flow returned to the baseline for the dorsal hand after SCP bathing, but the increase was prolonged after α-EG bathing and more prolonged for tap water bathing.

5. Evaluation of moisturizing effects by an analyzer for skin corneal water content

High-frequency conductance of skin corneal layer divided by pre-bathing level was plotted on
the vertical line to compare the degree of skin moisture. At 10min. later after bathing, the water content in the corneal layer was 3 times higher at the femoral region contacting with SCP bathing than those contacting with other two bathings. However, the water content, 20 min and 30 min after bathing was not different between three bathing and the contents were almost the same as the respective baselines (Fig.10).

Regarding the face not contacting with hot water, skin moisture increased at most 1.4–1.8 times after α-EG bathing or tap water one, but the increase by SCP bathing was as high as 2.3 times (Fig.11).

VI DISCUSSION

Systolic and diastolic blood pressures decreased after bathing by about 20 mmHg and 30 mmHg, respectively, whereas pulse rate increased ca. 15 times. However, the effects of taking a bath were not significantly different between SCP bathing or α-EG bathing and tap water bathing, indicating that the influence of SCP or α-EG bathing on the lung and heart would be similar to that of conventional bathing. The changes in skin surface temperature indicated that the temperature at the shoulder part at an early stage of bathing is controlled through sweating, but such control would become not effective within 10 min or so, resulting that the skin temperature would increase to a temperature similar to that of the forehead within 15 min or so. It is likely that the surface temperature of forehead would increase since an early time of bathing and directly reflect the thermal effects of bathing. Especially, it is noteworthy that skin temperature decrease after SCP bathing was significantly slower than α-EG or tap water bathing. It has been reported that heat-holding effects were produced by coating the skin with a surface membrane made from sodium bicarbonate, sodium sulfate or sodium chloride solution, resulting in some heat holding effects. This suggests that SCP bathing might exhibit such heat-holding effects through coating the skin with a membrane constructed by SCP. The present results from measurements by deep body thermometer showed that the body temperature increased more markedly from an early time of SCP bathing and α-EG than tap water bathing. The results were suggested that SCP bathing and α-EG bathing would enhance heat transfer from the bath to the body more markedly than tap water bathing. The data of blood vascular changes suggested that such heat transfer would be produced through increasing heat absorption rate, but not affecting vascular dilation. Therefore, it was likely that α-EG, a typical ingredient of sake concentrate would have caused the heat absorption increase during SCP bathing.

The changes in dorsal foot blood flow in hot water were larger for SCP and α-EG bathings than tap water one. The results of blood flow and deep body temperature indicate that SCP bathing and α
-EG would contain some components, α-EG should be one of them, usable for environmental conditions that allows easy transfer of heat from bath to the body. Since it seems unlikely that such heat transfer effects were produced only by α-EG, another component(s) would have been involved in the heat transfer. Regarding body regions immersed in bath, blood flow level after bathing was almost the same among α-EG, SCP and tap water bathings. Therefore, it seemed that those components would have no effects on blood vessels after bathing. The post-bath effects on dorsal hand would reflect the moisturizing effects including temperature-holding effects through making it difficult to release the heat trapped into the body. The blood flow changes by taking a bath were compared between in the dorsal hand and in the dorsal foot. The blood flow in a body region not contacting with bath water did not change after bathing for 15 min or less. Therefore, it was concluded that the blood flow increases by SCP and α-EG bathing are direct effects and so, direct contact with either bath water is needed for increasing the blood flow.

Based on these results, it was suggested that SCP bathing would have some effects as follows, easy heat transfer from bath water to the body and maintain to release the heat once trapped in the body. The effective component in SCP was regarded as a soluble compound of which heat transfer and heat preserving effects are were stronger than those of α-EG, by itself. The component did not affect blood vessels directly. Therefore, it seemed that hot water containing SCP and α-EG is little burden to the heart, lung and peripheral blood vessels.

Measurement of water content of the skin showed that the water content of a body region out of bath water was larger in SCP bathing than the other two, and a feeling of well moisturized skin was obtained at an early time after bathing. However, the water content decreased same levels to the other two about 20 min after bathing. This shows that skin moisture was kept till an early time after bathing, but the moisturizing conditions of a body region immersed in bath water returned to the pre-bathing ones in comparatively an early time.

The moisture content in corneal layer of facial skin was higher after SCP bathing than α-EG and tap water bathings, although the facial skin was not directly contacted with bath water. This indicates that skin moisture increased more markedly by SCP bathing than α-EG and tap water bathings. So it is expected that the moisture of the sweat increased for the improvement of the blood circulation by the maintain of heat to the body. In addition, it is likely that some component other than α-EG in SCP might be involved in the increase of skin moisture. Anyway, the water content of corneal layer for facial skin can be expected to sweat easily and renews it excellently and to purify with replacement of the wastes.

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Summary

We evaluated the effects of SCP bathing on the body by compared with those of α-EG, one of major component of SCP, bathing and the control bathing with tap water alone. Healthy adults were used as the subjects. The effects of bathing on blood pressure and pulse rate were not significantly different among the three bathings, indicating that effects of SCP and α-EG bathing on the lung and heart were similar to those of an ordinary bathing. The surface skin temperature at the forehead decreased more slowly in the subjects after taking a SCP bathing than the other two, suggesting that SCP has temperature holding effects. Also, the results of deep body temperature suggested that α-EG might be related to the heat absorbing effects of SCP bathing, which were significantly marked than those of the other two bathings. The present results regarding the changes in blood flow and deep body temperature during bathing suggest that SCP might produce an environment that allows more rapid heat transfer from bath water to the body and less releasing it from the body. Therefore, we concluded that some component other than α-ethylglucoside would be involved in the heat transfer and moisturizing during SCP bathing. Measurement of skin water content indicated that a region directly contacting with hot water was moisturized in a short time, but this condition quickly returned to the pre-bath condition. Whereas, for regions not contacting with bath water, the skin was much more moisturized by taking SCP bath than the other two bathings. Therefore, it was concluded that SCP is effective for enhancement of skin moisturizing.