Original Article

Evaluation of the Effect of α Gel embedded Mattresses as Bedding on the Mind and Body.Yoshikazu YONEI¹⁾, Yoko TAKAHASHI¹⁾, Atsushi SHIONOIRI²⁾, Shino INADA³⁾

1) Anti-Aging Medical Research Center, Doshisha University

2) Anti-Aging Medicine Laboratory, Faculty of Medicine, the University of Tokyo

3) Physiology Laboratory, Tokyo Medical and Dental University

KEY WORDS: Clinical Study, Anti-Aging Medicine, Quality of Sleep, Lifestyle, QOL**Abstract**

We conducted an open parallel comparison study between Groups to evaluate the possible influence on mental and physical conditions of using a mattress and pillow in which a gel was embedded for 4 weeks. The study subjects consisted of 41 Japanese healthy adult volunteers with high total scores (7 or more) of Pittsburgh Sleep Quality Index and of both sexes aged between 35 to 57 (42.8 ± 5.5) years old. They were divided into 2 groups; the Control Group consisting of 21 subjects and the Study Group consisting of 20 subjects. In the Study Group, DHEA-s (-9.8%) and the creatinine-corrected urinary 8-OHdG (-16.7%) was significantly decreased, and cortisol (27.7%) significantly increased. Of the physical symptoms, "Blurry eyes", "Lethargy", and "Coughing and sputum" significantly improved in the Study Group compared with control. Of the mental conditions, "No feeling of happiness", "Shallow sleep" and "Difficulty falling asleep" significantly improved in the Study Group. For Lifestyle, only the Study Group was affected. Specifically, the "Frequency of alcohol intake" significantly increased along with the "Sleeping hours" ($p < 0.05$). For the survey which entailed using the Pittsburgh Sleep Quality Index, the Study Group showed a significant improvement in "Quality of sleep" ($p < 0.01$), "Sleeping hours" ($p < 0.05$), and "Difficulty staying awake during the day" ($p < 0.05$). Total score decreased from 9.30 ± 2.36 to 6.05 ± 2.80 ($p < 0.001$). These data indicates that the use of a mattress and pillow in which a gel is embedded for four weeks should improve one's quality of sleep and some physical and mental symptoms for healthy adult males and females.

Introduction

The purpose of anti-aging medicine is to achieve health and longevity. It does not just mean prolonging a person's life expectancy. Its purpose is also to make it possible to achieve good health, happiness and to lead an enjoyable life while preventing mental and physical decline. Thus anti-aging medicine aims to maintain a good quality of life (QOL)¹⁻⁴⁾. Academically, it is a branch of preventive medicine. The practice of anti-aging medicine involves anti-aging check-ups for diagnosis¹⁾ and life-long practices such as diet/exercise therapy and drug therapy including supplement and hormone substitution therapies.

In recent years, key words such as integrative medicine, alternative medicine, herbal medicine, acupuncture and moxibustion treatment and anti-aging medicine have often been used. In addition, various treatments which differ from conventional Western medicine have been proposed. Although many reports exist on the effectiveness of these treatments and therapies, at present there is an absence of common parameters used in their evaluation. Therefore many non-specialist physicians have yet to answer the question of to what symptoms or diseases these treatments and therapies can be applied and

how effective they are.

Until now, we have studied and evaluated using common parameters the effectiveness of medical check-ups as well as the possible effects of supplements, health foods, medical devices, exercise machine and tools, and cosmetics, etc. on mental and physical symptoms and their safety^{5,6)}. Our research efforts are revealing the extent and limit of these products and their spectrum of applicability.

The Ministry of Health and Welfare (MHW) handed down to each municipal corporation the notification "Healthy Japan 21" in March 2000. This notification specified nine Groups of directives related to individual lifestyle and the causes of lifestyle-dependent diseases. One of these Groups, "Rest; Maintaining Mental Health", maintained that mental and physical health can be fulfilled by (i) adequate quality and quantity of exercise; (ii) the intake of well-balanced nutrients and good eating habits; and (iii) rest. These three elements were stated to be prerequisites for achieving and maintaining good health. With regard to the term "rest", the MHW deemed sleep in particular to have a great influence on the QOL. It additionally stated that it would "make it the goal to reduce the ratio of 'those who cannot have sufficient rest by sleep' by 10 % or more and at

the ratio of ‘those who sometimes use sleeping aids (sleeping pills and tranquilizers) or alcohol to help go into sleep’ by 10 % or more by the year of 2010”. To achieve this, the “Health Network” identified steps to be taken to tackle sleep as one of the tasks that is required to achieve “Rest; Mental Health”. It further proposed three courses of action for people to obtain a pleasant sleep, which consisted of: “reconsidering sleep and bedding”, focusing on the “science of bedding and good sleep” as well as “bedding for good sleep”. Bedding manufacturers now offer various types of bedding to help people obtain a pleasant sleep, most of which have been developed from the viewpoint of the mechanism which is responsible for sleep.

In this study, we evaluated the effect and safety of the use of a mattress and pillow in which alpha gel has been embedded on mental and physical symptoms using healthy adult volunteers. In particular we emphasized parameters which are regarded as being important to anti-aging medicine. In addition, we analyzed whether such a mattress and pillow could improve the QOL or not.

Subjects and Methods

•Subjects

Sixty volunteers who satisfied the following selection criteria were enrolled in this study:

- (1) Japanese of either sex whose age was between 30 to 59 years.
- (2) Those who were office workers who spent four days or more of per week in the office.
- (3) Those that were aware they were suffering from a mild sleep disorder such as difficulty falling asleep or shallow sleep.
- (4) Those who usually slept on a futon on a tatami mat or on the floor.
- (5) Those who could honor their appointment to visit the designated clinical site.

At the same time following exclusion criteria were also applied to eliminate unsuitable candidates from the Study Group:

- (1) Those using drugs which might influence the test results such as hormone agents or osteoporosis remedies.
- (2) Those who consumed daily health foods which might have influenced the test results.
- (3) Those who were or might be pregnant or lactating;
- (4) Those who consumed excessive amounts of alcohol.
- (5) Those who were participating in other clinical studies.
- (6) Those who suffered from chronic diseases such as diabetes or severe liver failure.
- (7) Those who had severe liver, renal, heart or blood diseases or other complications.
- (8) Those who were highly anemic.
- (9) Those for whom the chief investigator of this study found to be unsuitable for the purposes of this study.

Each subject provided their written consent to participate in the study. Of the 60 suitable candidates who were identified, we selected 41 subjects with higher scores (Total score; 7 or more) of the Pittsburgh Sleep Quality Index (Japanese version) ⁷⁾ on September 17th, 2005. The subjects were 42.8±5.5 (range: 35-57) years old.

The products evaluated in this study, hereinafter referred to as the “TEST PRODUCT”, consisted of a mattress and a pillow that were obtained on loan from GELTEC Co, Ltd. (Tokyo). The bedding consisted of material embedded in α gel and was placed between special urethane foam. α gel is a “very soft gel material made mainly of silicone” and possesses the ability to cushion. This property has been said to “be incredible so as to prevent an egg from getting broken after 18 meter fall”. According to information from the manufacturer, α gel is transparent in appearance, and has a specific gravity of 0.98. Its penetration, a characteristic which is used to measure the hardness of a material which is specified by JIS K2207, is rated as 150. It also has a hardness score of 1, corresponding to a depth of 1/10mm by which a needle with a prescribed weight can penetrate a sample of the material after entering it at right angles. The tensile strength of the α gel, which is a measure of the strength required to tear the gel and was determined using the method which conforms to the standards of JIS K6251, is 0.03 Mpa. To determine this it was necessary to first calculate the tearing stress, which was obtained by dividing the strength required to pull a sample of the gel using a load with a fixed rate until it tore across its cross-sectional profile. Additional properties of the α gel include an elongation percentage of 340 %, Young’s modulus of 28.9kPa, specific heat of 1.55 J/g·K, heat conductivity of 0.18 W/m·K, volume resistivity of 2.1×10^{14} Ohm·cm, dielectric breakdown strength of 16.7 kV/mm, and usable temperature range of -40 to 200°C. The α gel is soluble in toluene, acetone, fuel oil and lubricating oil, and is tolerant to methanol, distilled water, 10 % NaCl, 10 % HCl and 5 % NaOH.

•Methods

The 41 subjects who were selected by screening were randomly divided into two Groups, with 21 non-users being assigned to a Control Group and 20 users being assigned to a Study Group so that the male: female ratio was 1:1 and the average age and score on the Pittsburgh Sleep Quality Index ⁷⁾ was equal between the Groups. The subjects fasted for five hours prior to the beginning of the study, and received examination in the morning (from 9 to 11 AM). The consumption of water was allowed but the consumption of alcohol a day prior to the observation day was prohibited. The subjects were also requested to avoid leading an irregular lifestyle during the test period and to maintain their normal quantity and quality of sleep, meals and levels of exercise similar. They were also asked to not use products which might improve their quality of sleep such as health foods other than the TEST PRODUCT, and were advised to consume sufficient water if they if they were required to give blood on each observation day for analysis.

This investigation was designed as a non-controlled open study which had no control product, and was planned as a parallel comparative study between two Groups, a group of non-users of the TEST PRODUCT, termed the Control Group, and that of users of the TEST PRODUCT, termed the Study Group. An ethical committee was set up for the study, from which approval to proceed was obtained. The study was carried out in compliance with the study protocol as well as ethical principles based on the “Declaration of Helsinki” as revised at the General Assembly in Edinburgh in 2000. This study also obeyed “An ethical principle about an epidemiologic study” by the Ministry of Health, Labour and Welfare <http://www.niph.go.jp/wadai/ekigakurinri/ekigakurinri170401/shishin-all.pdf>.

The TEST PRODUCT was shipped to each subject by the study sponsor (GELTEC Co., Ltd. Tokyo) following the first observation. Prior to shipment, each subject received an explanation in written and oral form on how to use and care for the TEST PRODUCT. After completion of the study, the TEST PRODUCT was returned to the research contractor (SOUKEN LAB, Tokyo).

The observations took place prior to the beginning of the study on September 24th, 2005 and after using the TEST PRODUCT for four weeks on October 22nd, 2005. This study began on September 17th, 2005 and ended on October 22nd, 2005.

Physical Measurements and Clinical Laboratory Tests

Physical Measurements and Tests

The measurement of weight (kg), blood pressure (systolic/diastolic blood pressure in mmHg) and pulse rate (/min) was carried out twice during the course of the study, prior to the use of the TEST PRODUCT and four weeks after its use. Each subject's height (cm) was measured only once prior to use.

Clinical Laboratory Tests

Hematological tests performed in this study included examination of the following parameters: white blood cell (WBC) count (/ μ l), red blood cell (RBC) count (/ μ l), hemoglobin (g/dl), HbA1c (%), hematocrit (%), mean cell volume (fl), mean corpuscular hemoglobin (pg), mean corpuscular hemoglobin concentration (%) and platelet count ($\times 10^4/\mu$ l). The following biochemical parameters for blood were also examined: total protein (g/dl), uric acid (mg/dl), total bilirubin (mg/dl), CPK (CK, IU/l), ALP (IU/l), BUN (mg/dl), creatinine (mg/dl), total cholesterol (mg/dl), HDL-cholesterol (mg/dl), LDL-cholesterol (mg/dl), triglyceride (mg/dl), blood glucose (mg/dl), AST (GOT, IU/l), ALT (GPT, IU/l), γ -GTP (IU/l), LDH (IU/l), serum electrolyte (Na, K, Cl: mEq/l), Ca, inorganic phosphorus (mg/dl), HbA1c (%), lipid peroxide (μ M), cortisol (μ g/dl), dehydroepiandrosterone sulfate (DHEA-s, ng/ml), insulin-like growth factor (IGF)-I (somatomedin C, ng/ml), testosterone (ng/ml), and estradiol (pg/ml). Urine analysis was used to investigate urinary output (ml), duration of urine collection (hr), levels of 8-hydroxy 2'-deoxyguanosine (8-OHdG, ng/ml), isoprostane (ng/ml), urinary creatinine (mg/ml) and pH. Blood and urine analyses were performed by Mitsubishi Kagaku Bio-Clinical Laboratories, Inc. (Tokyo) and the Department of Assay Business for Aging Control, Nikken SEIL Co., Ltd (Fukuroi, Shizuoka Prefecture).

Oxidization Stress Markers

Urine 8-OHdG and isoprostane ⁸⁻¹¹⁾ were used as oxidization stress markers. These parameters were measured at the Department of Assay Business for Aging Control, Nikken SEIL Co., Ltd. In addition, 8-OHdG, isoprostane and creatinine levels from the first morning's urine were measured, and based on urinary output and duration of collection of urine, the time interval from the last urination before going to bed to the first urination of the next morning, the generation rate of 8-OHdG and isoprostane as well as creatinine-corrected value (8-OHdG/CRE and isoprostane/CRE) were calculated.

Pittsburgh Sleep Quality Index

Table 1 shows the Pittsburgh Sleep Quality Index ⁷⁾ and the criteria that were used for scoring. The Pittsburgh Sleep Quality

Index (PSQI) was translated into Japanese by Yuriko Doi, et al. (PSQI-J), and was used as a criterion for evaluating sleep in terms of "time" and "quality", "the extent of difficulty inflicted on daily life", etc ⁷⁾.

Table 1 Criteria for Scoring using the Pittsburgh Sleep Quality Index

Symptoms	Criteria
Sleep quality	The score was calculated using the following scale: very good=0, good=1, bad=2, very bad=3.
Time required to fall asleep ^{a)}	The score was calculated using the following scale: "0":0, "1-2":1, "3-4":2, "5-6":3.
Sleeping time	The score was calculated using the following scale: longer than 7 hours=0, longer than 6 hours but shorter than 7 hours=1, longer than 5 hours but shorter than 6 hours=2, shorter than 5 hours=3
Efficiency of sleep ^{b)}	The score was calculated using the following scale: 85% or more=0, more than 75% but less than 85%=1, more than 65% but less than 75%=2, less than 65%=3.
Difficulty sleeping ^{c)}	The score was calculated using the following scale: "0":0, "1-9":1, "10-18":2, "19-27":3.
Use of sleeping pills Difficulty staying awake	The score was calculated using the following scale: never=0, less than once a week=1, once or twice a week=2, three times a week or more=3.
during the daytime ^{d)}	The score was calculated using the following scale: "0":0, "1-2":1, "3-4":2, "5-6":3.
Total score ^{e)}	Total of the scores of the parameters listed above.

Refer to the Pittsburgh Sleep Quality Index for details.

a) Regarding the second question of the Pittsburgh Sleep Quality Index, we allocated 0 to "less than 16 min.", 1 to "longer than 16 min. but less than 31 min.", 2 to "longer than 31 min. but shorter than 61 min." and 3 to "longer than 61 min.", respectively, and then calculated the score. The score in this column represents the total of this calculation and the score Question 5 a.

b) Efficiency of sleep (%) = actual length of sleep/time spent in bed $\times$ 100.

c) The total of the scores of Questions 5b through j of the Pittsburgh Sleep Quality Index.

d) The total of the scores of Questions 8 and 9 of the Pittsburgh Sleep Quality Index

e) With the total score ranging between 0 – 21, the higher the total score was, the worse the subjective quality of sleep was.

Common Interview Sheet for the QOL

Subjective symptoms were classified as "physical symptoms" and "mental symptoms" and evaluated on a scale ranging from 1 – 5 using the Anti-Aging Common Interview Sheet for the QOL (Anti-Aging QOL Common Questionnaire: AAQol) ^{2,5,6)}.

Safety Evaluation

We determined that there was no problem regarding safety since the TEST PRODUCT was bedding consisting of a mattress and pillow that is used in everyday life.

Method of Statistical Analysis

Dr.SPSSII, a software program that was designed for statistical analysis (manufactured by SPSS Inc.) was used in this study. The t-test was performed to compare the back grounds of the Study Group and the Control Group. The paired t-test was used to compare the measured values between the level at baseline (A) and that after 4 weeks of trial (B) in each group. For inter-group comparison, the values of difference (B – A) were analyzed by Wilcoxon's signed rank test. The level of significance was set at 5 % or less.

Results

•Background factors

Table 2 shows background factors (physical measurements) as a whole as well as those with respect to each sex. There was no significant difference between the males and females as well as the Groups in terms of the other background factors for the subjects or in physical structure before and after use of the TEST PRODUCT. Therefore, it was confirmed that randomization of the subjects into the Control Group and the Study Group was almost uniform.

Table 2-1 Overall Subject Backgrounds

Factors	Study Group	Control Group
Number (persons)	20	21
Age (years)	42.7 $\pm$ 6.0	42.8 $\pm$ 5.1
Height (cm)	165.5 $\pm$ 8.8	163.5 $\pm$ 7.8
Weight (kg)	66.1 $\pm$ 18.3	63.7 $\pm$ 13.8

Mean $\pm$ SD, t test.

Table 2-2 Male Subject Backgrounds

Factors	Study Group	Control Group
Number (persons)	11	10
Age (years)	42.8 $\pm$ 5.2	44.7 $\pm$ 5.1
Height (cm)	171.5 $\pm$ 5.7	169.2 $\pm$ 6.0
Weight (kg)	76.8 $\pm$ 17.5	72.2 $\pm$ 14.3

Mean $\pm$ SD, t test.

Table 2-3 Subject Backgrounds

Factors	Study Group	Control Group
Number (persons)	9	11
Age (years)	42.6 $\pm$ 7.2	41.1 $\pm$ 4.7
Height (cm)	158.0 $\pm$ 5.4	158.3 $\pm$ 5.2
Weight (kg)	53.1 $\pm$ 7.7	56.0 $\pm$ 7.6

Mean $\pm$ SD, t test.

•Change in Physical Examinations

Table 3 shows changes in physical structure prior to use of the TEST PRODUCT and 4 weeks after use as well as the difference between the Groups. No significant differences were observed.

Table 3 Differences in Physical Composition between the Groups and Sequential Changes.

Measure-ment	Unit	Group	Before use	After 4 weeks	p value (Before vs. After)	p value between the Groups
Total body muscle	kg	Study	46.6 $\pm$ 11.4	46.7 $\pm$ 11.4	0.696	0.486
		Control	44.6 $\pm$ 10.1	44.7 $\pm$ 9.9	0.645	
Total body fat	kg	Study	16.7 $\pm$ 7.9	16.8 $\pm$ 7.9	0.860	0.319
		Control	16.5 $\pm$ 5.8	16.4 $\pm$ 5.9	0.608	
Weight	kg	Study	66.1 $\pm$ 18.3	66.2 $\pm$ 18.3	0.399	0.344
		Control	63.7 $\pm$ 13.8	63.7 $\pm$ 13.7	0.940	
Percentage body-fat	%	Study	24.7 6.2	24.7 6.3	0.925	0.315
		Control	25.8 6.3	25.6 6.3	0.340	
BMI		Study	23.9 4.6	23.9 4.6	0.414	0.333
		Control	23.7 3.9	23.7 3.8	0.990	

Mean $\pm$ SD, Study group n=20, Control group n=21. Before vs. After ; paired t-test. Between the Groups; Wilcoxon's signed rank test.

Table 4 shows sequential changes in blood pressure and pulse rate and the differences between the Groups before and after use of the TEST PRODUCT. The Control Group, which did not use the TEST PRODUCT, showed a significant decrease in systolic blood pressure and diastolic blood pressure 4 weeks after commencing the study ($p<0.05$, $p<0.001$, respectively). The Study Group, on the other hand, showed a significant decrease only in the diastolic blood pressure ($p<0.001$). The inter-group analysis showed no significant difference between 2 groups.

Table 4 Sequential Changes in Blood Pressure and Pulse Rate and the Differences between the Groups

Measure-ment	Group	Before use	After 4 weeks	p value (Before vs. After)	p value between the Groups
Systolic blood pressure(mmHg)	Study	122 $\pm$ 16	119 $\pm$ 18	0.348	0.349
	Control	118 $\pm$ 12	114 $\pm$ 15	0.023	
Diastolic blood pressure(mmHg)	Study	79 $\pm$ 11	75 $\pm$ 12	0.001	0.485
	Control	78 $\pm$ 13	74 $\pm$ 12	0.001	
Pulse rate/min.	Study	71.8 $\pm$ 10.5	72.4 $\pm$ 8.4	0.741	0.262
	Control	76.5 $\pm$ 11.2	75.5 $\pm$ 8.9	0.569	

Mean $\pm$ SD, Study group n=20, Control group n=21. Before vs. After ; paired t-test. Between the Groups; Wilcoxon's signed rank test.

•Changes seen by Clinical Laboratory Tests

Table 5 shows sequential changes in hematological test parameters and blood biochemical parameters and the differences between the Groups. In hematological test, a change in WBC and mean corpuscular hemoglobin was different in two groups; however, changed values were slight.

Regarding the Study Group, serum AST (-6.9% , $p<0.05$), γ -GTP (-11.1% , $p<0.05$) and LDH (-9.8% , $p<0.01$) significantly decreased, and potassium (7.0% , $p<0.01$) significantly increased. Slight changes were noted in creatinine (-2.7% , $p<0.05$) and calcium (-2.4% , $p<0.01$). These changes were within the physiological range. Between 2 groups, there was no difference in changes of AST, γ -GTP, LDH, creatinine, and calcium. Only Inorganic phosphorus showed difference in change.

Concerning to the hormone (**Table 5-2**), IGF-I significantly decreased in the both group, -13.9% and -15.8% , respectively. There was no significant difference in IGF-I changes between 2 groups. Cortisol increased only in the Study Group (27.7% , $p<0.05$). DHEA-s decreased only in the Study Group (-9.8% , $p<0.05$), and this change was significant compared with control. There were no significant changes in testosterone and estradiol. Lipid peroxide remained the same level in the Study group, while significantly increased in control (27.0% , $p<0.01$).

Table 5-3 shows sequential changes in the oxidative stress markers results and differences between the Groups. The Study Group showed a significant decrease in 8-OHdG/CRE, a marker for gene damage, from 7.66 ± 1.87 ng/mgCRE to 6.38 ± 2.44 ng/mgCRE (-16.7% , $p=0.005$), while no significant change occurred in the control. However, the inter-group analysis did not show significant difference.

Table 5-1 *Changes in Hematological Test Parameters and Blood Biochemical Parameters.*

Test parameters	Group	Before use	After 4 weeks	p value (Before vs. After)	p value between the Groups
White blood cell count(μ l)	Study	5715 $\pm$ 1828	5240 $\pm$ 1519	0.068	0.036
	Control	5452 $\pm$ 1414	5681 $\pm$ 1538	0.439	
Red blood cell count($\times 10^4/\mu$ l)	Study	461 $\pm$ 53	454 $\pm$ 42	0.135	0.109
	Control	450 $\pm$ 44	453 $\pm$ 52	0.646	
Hemoglobin (g/dl)	Study	14.1 $\pm$ 1.7	13.8 $\pm$ 1.4	0.081	0.199
	Control	13.7 $\pm$ 1.5	13.7 $\pm$ 1.6	0.750	
Hematocrit (%)	Study	43.9 $\pm$ 4.6	43.2 $\pm$ 3.9	0.120	0.122
	Control	42.6 $\pm$ 4.1	42.9 $\pm$ 4.8	0.714	
Mean cell volume (fl)	Study	95.5 $\pm$ 5.2	95.4 $\pm$ 4.8	0.680	0.421
	Control	94.8 $\pm$ 4.8	94.7 $\pm$ 4.9	0.448	
Mean corpuscular hemoglobin(pg)	Study	30.5 $\pm$ 2.0	30.4 $\pm$ 1.8	0.112	0.047
	Control	30.6 $\pm$ 1.9	30.2 $\pm$ 1.8	0.001	
Mean corpuscular hemoglobin concentration (%)	Study	32.0 $\pm$ 0.9	31.8 $\pm$ 0.8	0.225	0.092
	Control	32.2 $\pm$ 0.7	31.9 $\pm$ 0.7	0.004	
Platelet count ($\times 10^4/\mu$ l)	Study	24.4 $\pm$ 4.1	24.5 $\pm$ 4.3	0.810	0.083
	Control	25.5 $\pm$ 6.1	27.0 $\pm$ 7.0	0.102	
AST (GOT) (IU/l)	Study	27.4 $\pm$ 14.6	25.5 $\pm$ 14.3	0.048	0.130
	Control	21.0 $\pm$ 7.6	22.5 $\pm$ 12.4	0.601	
ALT (GPT) (IU/l)	Study	33.6 $\pm$ 23.7	33.9 $\pm$ 36.4	0.952	0.458
	Control	23.2 $\pm$ 16.7	24.1 $\pm$ 15.7	0.831	
γ -GTP (IU/l)	Study	73.3 $\pm$ 91.5	65.2 $\pm$ 81.0	0.026	0.081
	Control	34.9 $\pm$ 29.8	33.5 $\pm$ 25.5	0.682	
LDH (IU/l)	Study	194 $\pm$ 31	175 $\pm$ 29	0.003	0.248
	Control	178 $\pm$ 25	163 $\pm$ 24	0.004	
Total protein (g/dl)	Study	7.39 $\pm$ 0.38	7.18 $\pm$ 0.37	0.023	0.076
	Control	7.36 $\pm$ 0.24	7.31 $\pm$ 0.36	0.447	
Uric acid (mg/dl)	Study	6.10 $\pm$ 1.70	6.11 $\pm$ 1.93	0.956	0.430
	Control	5.21 $\pm$ 1.54	5.29 $\pm$ 1.45	0.687	
Total bilirubin (mg/dl)	Study	0.580 $\pm$ 0.209	0.505 $\pm$ 0.147	0.238	0.488
	Control	0.710 $\pm$ 0.409	0.638 $\pm$ 0.402	0.462	
CPK (CK) (IU/l)	Study	146 $\pm$ 109	135 $\pm$ 69	0.669	0.368
	Control	118 $\pm$ 120	94 $\pm$ 40	0.377	
ALP (IU/l)	Study	197 $\pm$ 44	188 $\pm$ 47	0.066	0.076
	Control	184 $\pm$ 51	184 $\pm$ 51	0.943	
BUN (mg/dl)	Study	13.9 $\pm$ 2.6	13.0 $\pm$ 3.5	0.230	0.372
	Control	13.1 $\pm$ 3.0	12.6 $\pm$ 3.4	0.383	
Creatinine (mg/dl)	Study	0.809 $\pm$ 0.132	0.787 $\pm$ 0.135	0.019	0.371
	Control	0.740 $\pm$ 0.143	0.727 $\pm$ 0.139	0.251	
Total-Chol (mg/dl)	Study	213 $\pm$ 25	206 $\pm$ 23	0.090	0.112
	Control	210 $\pm$ 31	210 $\pm$ 33	0.954	
HDL-Chol (mg/dl)	Study	66.4 $\pm$ 18.0	64.5 $\pm$ 22.0	0.227	0.416
	Control	65.8 $\pm$ 15.8	64.4 $\pm$ 16.6	0.377	
LDL-Chol (mg/dl)	Study	126 $\pm$ 27	122 $\pm$ 26	0.219	0.077
	Control	126 $\pm$ 31	130 $\pm$ 31	0.399	
Triglyceride (mg/dl)	Study	116.5 $\pm$ 64.0	131.1 $\pm$ 109.6	0.385	0.239
	Control	99.1 $\pm$ 78.3	97.8 $\pm$ 76.1	0.930	
Glucose (mg/dl)	Study	90.1 $\pm$ 10.2	90.4 $\pm$ 15.8	0.921	0.458
	Control	92.1 $\pm$ 14.7	92.0 $\pm$ 11.7	0.974	
Sodium (Na) (mEq/l)	Study	143 $\pm$ 2	142 $\pm$ 2	0.061	0.183
	Control	142 $\pm$ 2	142 $\pm$ 1	0.287	
Potassium (K) (mEq/l)	Study	3.86 $\pm$ 0.34	4.13 $\pm$ 0.30	0.001	0.163
	Control	3.96 $\pm$ 0.32	4.13 $\pm$ 0.28	0.036	
Chlorine (Cl) (mEq/l)	Study	103 $\pm$ 2	104 $\pm$ 1	0.081	0.446
	Control	103 $\pm$ 2	104 $\pm$ 2	0.123	
Calcium (Ca) (mg/dl)	Study	9.27 $\pm$ 0.27	9.05 $\pm$ 0.29	0.002	0.206
	Control	9.20 $\pm$ 0.22	9.06 $\pm$ 0.24	0.045	
Inorganic phosphorus (mg/dl)	Study	2.88 $\pm$ 0.56	2.93 $\pm$ 0.42	0.582	0.005
	Control	2.89 $\pm$ 0.51	3.23 $\pm$ 0.43	0.001	
HbA1c (%)	Study	4.98 $\pm$ 0.39	4.99 $\pm$ 0.35	0.725	0.460
	Control	5.14 $\pm$ 0.86	5.15 $\pm$ 0.77	0.651	

Mean $\pm$ SD, Study group n=20, Control group n=21. Before vs. After ; paired t-test. Between the Groups; Wilcoxon's signed rank test. Abbreviation: "Chol" : "cholesterol".

Table 5-2 *Change in Hematological Test Parameters and Blood Biochemical Parameters.*

Test parameters	Group	Before use	After 4 weeks	p value (Before vs. After)	p value between the Groups
Lipid peroxide (μ M)	Study	0.324 $\pm$ 0.150	0.386 $\pm$ 0.202	0.143	0.447
	Control	0.270 $\pm$ 0.087	0.343 $\pm$ 0.094	0.003	
Cortisol (μ g/dl)	Study	10.1 $\pm$ 4.0	12.9 $\pm$ 4.4	0.025	0.075
	Control	10.4 $\pm$ 4.6	11.1 $\pm$ 3.7	0.372	
DHEA-s (ng/ml)	Study	1930 $\pm$ 950	1740 $\pm$ 710	0.040	0.048
	Control	1550 $\pm$ 670	1560 $\pm$ 830	0.921	
IGF-I (ng/ml)	Study	194 $\pm$ 68	167 $\pm$ 46	0.021	0.352
	Control	203 $\pm$ 61	171 $\pm$ 41	0.005	
Testosterone a) (ng/ml)	Study	593 $\pm$ 196	521 $\pm$ 230	0.406	0.166
	Control	603 $\pm$ 179	627 $\pm$ 205	0.590	
Estradiol b) (pg/ml)	Study	82.1 $\pm$ 59.0	58.5 $\pm$ 39.9	0.202	0.088
	Control	102.5 $\pm$ 88.6	124.6 $\pm$ 113.4	0.410	

Mean $\pm$ SD, Study group n=20, Control group n=21. Before vs. After ; paired t-test. Between the Groups; Wilcoxon's signed rank test.

a) Testosterone was analyzed only for the male subjects.

b) Estradiol was analyzed only for the female subjects.

Table 5-3 *Change in Hematological Test Parameters and Blood Biochemical Parameters.*

Measurement	Group	Before use	After 4 weeks	p value (Before vs. After)	p value between the Groups
8-OHdG (ng/ml)	Study	11.1 $\pm$ 4.9	9.2 $\pm$ 5.0	0.159	0.101
	Control	9.4 $\pm$ 4.9	9.5 $\pm$ 5.8	0.867	
Isoprostane (ng/ml)	Study	9.00 $\pm$ 7.89	6.93 $\pm$ 6.69	0.323	0.154
	Control	6.83 $\pm$ 7.33	7.28 $\pm$ 5.94	0.748	
Creatinine (mg/dl)	Study	146 $\pm$ 67	142 $\pm$ 74	0.840	0.346
	Control	127 $\pm$ 68	132 $\pm$ 81	0.712	
8-OHdG/CRE(ng/mgCRE)	Study	7.66 $\pm$ 1.87	6.38 $\pm$ 2.44	0.005	0.099
	Control	7.50 $\pm$ 2.47	7.10 $\pm$ 2.50	0.444	
Isoprostane/CRE(ng/mgCRE)	Study	5.89 $\pm$ 3.54	4.22 $\pm$ 2.24	0.089	0.062
	Control	4.96 $\pm$ 3.41	5.17 $\pm$ 2.30	0.781	
8-OHdG generation rate (ng/kg/hr)	Study	6.41 $\pm$ 2.78	5.51 $\pm$ 2.96	0.269	0.482
	Control	7.03 $\pm$ 4.05	6.07 $\pm$ 3.88	0.234	
Isoprostane generation rate (ng/kg/hr)	Study	5.65 $\pm$ 7.14	4.07 $\pm$ 3.50	0.395	0.416
	Control	5.59 $\pm$ 7.91	4.55 $\pm$ 3.47	0.559	
Urinary output (ml)	Study	314 $\pm$ 107	351 $\pm$ 131	0.328	0.076
	Control	336 $\pm$ 146	306 $\pm$ 142	0.292	
Duration of urine collection (hr)	Study	7.85 $\pm$ 1.23	7.95 $\pm$ 1.16	0.693	0.333
	Control	6.80 $\pm$ 1.22	6.75 $\pm$ 1.21	0.845	

Mean $\pm$ SD, Study group n=20, Control group n=21. Before vs. After ; paired t-test. Between the Groups; Wilcoxon's signed rank test.

Changes in Subjective Symptoms by the QOL Interview Sheet

Table 6 shows sequential changes in subjective symptoms by the QOL interview sheet and differences between the Groups. After use of the TEST PRODUCT the subjects had showed significant improvements in the following physical symptoms: "Tired eyes" ($p<0.01$), "Stiff shoulders" ($p<0.05$), "Lethargy" ($p<0.01$) and "Easily breaking into a sweat" ($p<0.01$), while the following mental symptoms were significantly improved: "Loss of motivation" ($p<0.05$), "Shallow sleep" ($p<0.01$) and "Difficulty falling asleep" ($p<0.001$). The inter-group analysis revealed that the physical symptoms "Blurry eyes", "Lethargy", and "Coughing and sputum" and the mental symptoms "No feeling of happiness", "Shallow sleep", and "Difficulty falling asleep" improved significantly in the Study Group compared with control ($p<0.05$).

Table 6-1 *Sequential Changes in Subjective Symptoms and Differences between the Groups.*

Symptoms	Group	Before use	After 4 weeks	p value (Before vs. After)	p value between the Groups
Tired eyes	Study	2.70 $\pm$ 0.73	2.10 $\pm$ 0.97	0.005	0.060
	Control	2.52 $\pm$ 0.93	2.29 $\pm$ 1.01	0.096	
Blurry eyes	Study	1.95 $\pm$ 1.10	1.60 $\pm$ 1.05	0.124	0.040
	Control	1.29 $\pm$ 1.01	1.38 $\pm$ 1.02	0.480	
Eye pain	Study	1.00 $\pm$ 1.08	0.95 $\pm$ 0.94	0.655	0.211
	Control	1.10 $\pm$ 0.89	1.19 $\pm$ 1.03	0.480	
Stiff shoulders	Study	3.00 $\pm$ 1.26	2.65 $\pm$ 1.27	0.035	0.239
	Control	2.86 $\pm$ 1.06	2.67 $\pm$ 1.28	0.248	
Muscular pain/stiffness	Study	2.15 $\pm$ 1.04	2.30 $\pm$ 1.03	0.565	0.453
	Control	2.00 $\pm$ 1.00	2.19 $\pm$ 1.29	0.285	
Palpitations	Study	0.55 $\pm$ 0.69	0.60 $\pm$ 0.75	0.755	0.346
	Control	0.76 $\pm$ 0.89	0.90 $\pm$ 1.04	0.257	
Dyspnea	Study	0.70 $\pm$ 0.80	0.50 $\pm$ 0.51	0.285	0.092
	Control	0.76 $\pm$ 0.77	0.86 $\pm$ 0.91	0.414	
Tendency to gain weight	Study	2.10 $\pm$ 1.17	1.70 $\pm$ 0.98	0.052	0.240
	Control	2.38 $\pm$ 1.16	2.14 $\pm$ 1.24	0.096	
Weight loss; thin ^{a)}	Study	0.50 $\pm$ 0.83	0.45 $\pm$ 0.69	0.739	0.233
	Control	0.43 $\pm$ 0.81	0.57 $\pm$ 0.93	0.558	
Lethargy	Study	2.35 $\pm$ 1.09	1.70 $\pm$ 0.80	0.006	0.007
	Control	2.10 $\pm$ 0.62	2.05 $\pm$ 0.92	0.705	
No feeling of good health	Study	1.85 $\pm$ 0.81	1.55 $\pm$ 0.76	0.145	0.050
	Control	1.52 $\pm$ 0.98	1.62 $\pm$ 0.86	0.480	
Thirst	Study	1.25 $\pm$ 1.07	0.95 $\pm$ 1.00	0.092	0.194
	Control	1.14 $\pm$ 0.85	1.05 $\pm$ 0.86	0.317	
Skin problems	Study	1.55 $\pm$ 1.05	1.25 $\pm$ 1.12	0.244	0.149
	Control	1.52 $\pm$ 1.12	1.52 $\pm$ 0.93	1.000	
Anorexia	Study	0.45 $\pm$ 0.60	0.60 $\pm$ 0.68	0.257	0.210
	Control	0.76 $\pm$ 0.77	0.71 $\pm$ 0.72	0.813	
Early satiety	Study	1.15 $\pm$ 0.75	1.05 $\pm$ 0.94	0.718	0.377
	Control	0.86 $\pm$ 0.73	0.86 $\pm$ 0.79	1.000	
Epigastralgia	Study	1.15 $\pm$ 0.88	0.90 $\pm$ 0.91	0.290	0.280
	Control	0.67 $\pm$ 0.80	0.57 $\pm$ 0.75	0.414	
Liable to catch colds	Study	0.80 $\pm$ 0.62	0.80 $\pm$ 0.83	1.000	0.104
	Control	1.24 $\pm$ 0.62	1.48 $\pm$ 0.87	0.096	
Coughing and sputum	Study	1.25 $\pm$ 1.02	0.95 $\pm$ 1.05	0.083	0.043
	Control	1.33 $\pm$ 0.58	1.43 $\pm$ 0.81	0.527	
Diarrhea	Study	1.35 $\pm$ 0.88	0.95 $\pm$ 0.83	0.084	0.476
	Control	1.24 $\pm$ 0.94	0.86 $\pm$ 0.85	0.083	
Constipation	Study	1.30 $\pm$ 1.26	1.20 $\pm$ 1.32	0.480	0.417
	Control	1.29 $\pm$ 0.85	1.14 $\pm$ 1.15	0.317	

Mean $\pm$ SD, Study group n=20, Control group n=21. Before vs. After ; paired t-test. Between the Groups; Wilcoxon's signed rank test.

a) One is thinner than considered normal and feels pain or displeasure caused by such thinness.

Table 6-2 *Sequential Changes in Physical Symptoms and Differences between the Groups.*

Symptoms	Group	Before use	After 4 weeks	p value (Before vs. After)	p value between the Groups
Gray hair	Study	1.75 $\pm$ 1.12	1.75 $\pm$ 1.12	1.000	1.000
	Control	2.14 $\pm$ 1.20	2.14 $\pm$ 1.28	1.000	
Hair loss	Study	1.65 $\pm$ 0.81	1.65 $\pm$ 0.93	1.000	0.327
	Control	1.62 $\pm$ 0.86	1.52 $\pm$ 0.75	0.414	
Headache	Study	1.15 $\pm$ 0.99	1.20 $\pm$ 1.06	0.763	0.241
	Control	1.76 $\pm$ 0.94	1.62 $\pm$ 1.12	0.558	
Dizziness	Study	1.05 $\pm$ 0.94	0.75 $\pm$ 0.91	0.119	0.054
	Control	0.90 $\pm$ 0.94	1.10 $\pm$ 0.89	0.449	
Tinnitus	Study	0.60 $\pm$ 0.75	0.55 $\pm$ 0.83	0.705	0.401
	Control	0.62 $\pm$ 0.59	0.52 $\pm$ 0.60	0.414	

Lumbago	Study	2.40 $\pm$ 1.10	2.30 $\pm$ 1.26	0.617	0.358
	Control	2.10 $\pm$ 0.83	2.10 $\pm$ 0.89	1.000	
Arthralgia	Study	1.40 $\pm$ 1.10	1.05 $\pm$ 1.05	0.052	0.216
	Control	1.00 $\pm$ 0.95	0.86 $\pm$ 0.85	0.518	
Edematous	Study	1.50 $\pm$ 1.10	1.15 $\pm$ 0.99	0.090	0.412
	Control	1.52 $\pm$ 1.12	1.24 $\pm$ 1.09	0.190	
Easily breaking into a sweat	Study	2.45 $\pm$ 1.28	1.75 $\pm$ 1.16	0.006	0.090
	Control	2.38 $\pm$ 0.92	2.05 $\pm$ 0.97	0.070	
Frequent urination	Study	0.95 $\pm$ 0.94	0.85 $\pm$ 0.93	0.527	0.217
	Control	1.14 $\pm$ 0.96	0.86 $\pm$ 1.01	0.109	
Hot flash	Study	0.70 $\pm$ 0.86	0.60 $\pm$ 0.75	0.414	0.319
	Control	0.95 $\pm$ 0.67	0.95 $\pm$ 0.67	1.000	
Cold skin	Study	1.20 $\pm$ 1.24	0.90 $\pm$ 1.12	0.083	0.371
	Control	1.43 $\pm$ 1.40	1.19 $\pm$ 1.25	0.025	

Table 6-3 *Sequential Changes in Mental Symptoms and Differences between the Groups.*

Symptoms	Group	Before use	After 4 weeks	p value (Before vs. After)	p value between the Groups
Irritability	Study	1.65 $\pm$ 1.09	1.70 $\pm$ 0.98	0.739	0.405
	Control	1.76 $\pm$ 0.89	1.76 $\pm$ 0.70	1.000	
Easily angered	Study	1.45 $\pm$ 1.00	1.50 $\pm$ 0.95	0.763	0.405
	Control	1.52 $\pm$ 0.87	1.52 $\pm$ 0.68	1.000	
Loss of motivation	Study	1.85 $\pm$ 1.14	1.40 $\pm$ 0.99	0.029	0.139
	Control	1.48 $\pm$ 0.87	1.29 $\pm$ 0.85	0.206	
No feeling of happiness	Study	1.80 $\pm$ 1.20	1.40 $\pm$ 1.14	0.070	0.044
	Control	1.14 $\pm$ 0.57	1.14 $\pm$ 0.57	1.000	
Nothing to look forward in life	Study	1.35 $\pm$ 1.27	1.20 $\pm$ 1.32	0.366	0.188
	Control	1.05 $\pm$ 0.67	1.10 $\pm$ 0.70	0.739	
Daily life is not enjoyable	Study	1.55 $\pm$ 1.10	1.35 $\pm$ 1.14	0.102	0.245
	Control	1.14 $\pm$ 0.57	1.05 $\pm$ 0.59	0.317	
Loss of confidence	Study	1.50 $\pm$ 1.00	1.40 $\pm$ 1.10	0.527	0.165
	Control	1.10 $\pm$ 0.77	1.19 $\pm$ 0.68	0.414	
Reluctance to talk with others	Study	0.95 $\pm$ 1.00	0.90 $\pm$ 0.79	0.782	0.413
	Control	0.95 $\pm$ 0.74	0.86 $\pm$ 0.65	0.317	
Depressed	Study	1.05 $\pm$ 1.00	1.15 $\pm$ 1.14	0.564	0.405
	Control	0.86 $\pm$ 0.73	0.90 $\pm$ 0.70	0.705	
A sense of uselessness	Study	1.15 $\pm$ 0.88	1.20 $\pm$ 1.01	0.655	0.211
	Control	1.14 $\pm$ 0.57	1.05 $\pm$ 0.67	0.480	
Shallow sleep	Study	2.80 $\pm$ 0.83	1.70 $\pm$ 1.13	0.002	0.003
	Control	2.67 $\pm$ 0.80	2.43 $\pm$ 0.87	0.096	
Difficulty falling asleep	Study	2.20 $\pm$ 0.83	1.20 $\pm$ 0.95	<0.001	0.001
	Control	2.14 $\pm$ 1.11	1.90 $\pm$ 1.09	0.166	
Pessimism	Study	1.55 $\pm$ 1.19	1.35 $\pm$ 1.14	0.248	0.240
	Control	1.43 $\pm$ 0.68	1.38 $\pm$ 0.74	0.705	
Lapse of memory	Study	1.85 $\pm$ 0.99	1.55 $\pm$ 1.05	0.153	0.257
	Control	1.90 $\pm$ 0.70	1.76 $\pm$ 0.54	0.257	
Inability to concentrate	Study	1.70 $\pm$ 0.98	1.55 $\pm$ 1.05	0.257	0.485
	Control	1.76 $\pm$ 0.70	1.62 $\pm$ 0.67	0.317	
Inability to solve problems	Study	1.20 $\pm$ 0.77	1.30 $\pm$ 0.98	0.763	0.203
	Control	1.19 $\pm$ 0.60	1.10 $\pm$ 0.62	0.414	
Inability to make judgments readily	Study	1.20 $\pm$ 0.77	1.20 $\pm$ 1.01	0.763	0.349
	Control	1.10 $\pm$ 0.70	1.00 $\pm$ 0.63	0.480	
Inability to sleep because of worries	Study	1.50 $\pm$ 1.00	1.25 $\pm$ 1.16	0.132	0.178
	Control	1.48 $\pm$ 0.68	1.43 $\pm$ 0.68	0.739	
A sense of tension	Study	1.50 $\pm$ 1.10	1.35 $\pm$ 0.93	0.180	0.405
	Control	1.48 $\pm$ 0.75	1.38 $\pm$ 0.80	0.617	
Feeling of anxiety for no special reason	Study	1.25 $\pm$ 1.07	1.10 $\pm$ 1.12	0.490	0.419
	Control	1.05 $\pm$ 0.86	0.95 $\pm$ 0.80	0.527	
A vague feeling of fear	Study	0.80 $\pm$ 0.77	0.70 $\pm$ 0.80	0.627	0.336
	Control	0.67 $\pm$ 0.73	0.67 $\pm$ 0.66	1.000	

Mean $\pm$ SD, Study group n=20, Control group n=21. Before vs. After ; paired t-test. Between the Groups; Wilcoxon's signed rank test.

As **Table 6-4** shows, concerning Lifestyle, after use of the TEST PRODUCT, the Study Group had a significantly increased “Frequency of alcohol intake” ($p<0.05$) and significantly longer “Hours of sleep” ($p<0.05$) compared with the Control Group.

Table 6-4 Sequential Changes in Lifestyle and Differences between the Groups.

Measurement	Group	Before use	After 4 weeks	p value (Before vs. After)	p value between the Groups
Smoking (cigarettes/day)	Study	4.15 ± 7.31	4.55 ± 8.55	0.447	1.000
	Control	2.00 ± 6.00	2.00 ± 6.00	1.000	
Alcohol ^{a)} (go ^{b)} /day)	Study	1.18 ± 1.23	1.05 ± 1.28	0.287	0.142
	Control	1.20 ± 0.78	1.29 ± 0.77	0.595	
Frequency of alcohol intake (days/week)	Study	2.03 ± 2.52	2.36 ± 2.73	0.017	0.005
	Control	3.00 ± 2.51	2.76 ± 2.28	0.171	
Frequency of exercise (days/week)	Study	1.63 ± 2.03	1.83 ± 2.29	0.423	0.283
	Control	1.48 ± 1.57	1.52 ± 1.50	0.666	
Sleep (hr/day)	Study	5.13 ± 1.11	5.70 ± 1.17	0.025	0.017
	Control	5.24 ± 1.03	5.26 ± 1.19	0.803	
Water intake (l/day)	Study	1.72 ± 0.63	2.35 ± 4.17	0.493	0.179
	Control	1.71 ± 0.62	1.52 ± 0.66	0.057	

Mean±SD, Study group n=20, Control group n=21. Before vs. After ; paired t-test. Between the Groups; Wilcoxon's signed rank test.

a) In terms of Japanese Sake.

b) One “go” (Japanese unit of volume) corresponds to 180ml.

Changes in Scores for the Pittsburgh Sleep Quality Index

Table 7 shows sequential changes in scores for the Pittsburgh Sleep Quality Index and the differences between the Groups. The Study Group showed a significant improvement in “Sleep quality” ($p<0.01$), “Time required to fall asleep” ($p<0.01$), “Difficulty sleeping” ($p<0.05$) and “Difficulty staying awake during the day” ($p<0.01$), also a significant improvement in “time required to fall asleep” ($p<0.01$) and a significant prolongation in “Sleeping hours” ($p<0.05$) were observed. The inter-group analysis revealed that the changes in “Sleep quality”, “Sleeping

Table 7 Sequential changes in scores for the Pittsburgh Sleep Quality Index and the differences between the Groups.

Symptoms	Group	Before use	After 4 weeks	p value (Before vs. After)	p value between the Groups
Sleep quality	Study	1.90 ± 0.55	1.15 ± 0.75	0.002	0.005
	Control	1.71 ± 0.46	1.62 ± 0.67	0.564	
Time required to fall asleep	Study	1.80 ± 1.06	0.95 ± 0.89	0.002	0.051
	Control	2.00 ± 0.89	1.62 ± 0.92	0.059	
Sleeping hours	Study	2.25 ± 0.64	1.80 ± 0.83	0.021	0.019
	Control	2.24 ± 0.62	2.19 ± 0.60	0.564	
Efficiency of sleep	Study	0.65 ± 0.93	0.35 ± 0.93	0.107	0.313
	Control	0.90 ± 0.89	0.48 ± 0.68	0.039	
Difficulty sleeping	Study	1.20 ± 0.41	0.85 ± 0.59	0.020	0.361
	Control	1.33 ± 0.48	1.05 ± 0.22	0.034	
Use of sleeping pills	Study	0.00 ± 0.00	0.05 ± 0.22	0.317	0.282
	Control	0.05 ± 0.22	0.05 ± 0.22	1.000	
Difficulty staying awake during the day	Study	1.50 ± 0.61	0.90 ± 0.85	0.005	0.016
	Control	1.19 ± 0.68	1.10 ± 0.54	0.527	
Total score	Study	9.30 ± 2.36	6.05 ± 2.80	<0.001	0.009
	Control	9.43 ± 1.91	8.10 ± 2.72	0.019	

Mean±SD, Study group n=20, Control group n=21. Before vs. After ; paired t-test. Between the Groups; Wilcoxon's signed rank test.

hours” and “Difficulty staying awake during the day” are significant when compared with the control ($p<0.05$). As a result, the Study Group had a significantly lower “Total score” from 9.30 ± 2.36 to 6.05 ± 2.80 ($p<0.05$).

Discussion

Environmental factors which may influence the quality of sleep include sound insulation, lightness, room temperature, bedding and nightclothes. Room temperature and humidity are important when evaluating the quality of bedding such as hardness or elasticity of a mattress ¹²⁾. Furthermore, individual preference greatly influences the choice of bedding.

Few clinical studies on mattresses or beds are available. Of those that exist, one clinical investigation involved nine male subjects who used mattresses with two different types of hardness, one soft and the other firm, one after another for five consecutive nights. The results of the study revealed that four out of the nine subjects preferred the soft mattress, while two preferred the firm one, and that the rest did not like the change itself ¹³⁾. In addition, some of the subjects required several days until they became used to the new mattress. These findings may have been due to individual preferences.

A double blind study involving 265 hotel guests as subjects showed a significant correlation between the quality of sleep and the quality of the mattress. Analysis of the specific characters of the hotel guests showed that commercial travelers and guests with lumbar pain or sleep disorder were especially sensitive to eight-year-old mattress ¹⁴⁾.

A comparative three-phase A-B-A type study involving 30 patients with lumbar or back pain which compared an air bed with a spring bed showed that the air bed was more useful for improving subjective symptoms such as pain and the quality of sleep ¹⁵⁾.

Another study on a prescribed bedding system which proposed and prescribed bedding suitable for each of 22 patients with lumbar, back or shoulder pain (males: 9, females: 13, ages: 25 – 75 years) showed alleviation of pain and improvement in the quality of sleep after four weeks. This tendency was observed more markedly in the female subjects than in the male subjects and in slender subjects than in obese subjects ¹⁶⁾.

A pilot study was carried out in which female subjects with an average age of 61 years who had rheumatoid arthritis and who suffered from sleeping disorders due to chronic pain used a specially designed air floatation mattress for four weeks. The results of the study showed prolonged sleeping time from 3.8 hours to 4.9 hours and a reduction in the number of awakenings during the night from 4.9 to 2.3 and from an average duration of 25.3 min. to 14.2 min. Furthermore, the improvement of pain was also noted ¹⁷⁾.

Using a mattress and a pillow in which a gel was embedded (TEST PRODUCT) for 4 weeks led to improvements in five parameters of the seven of the Pittsburgh Sleep Quality Index. Improvements were also noted for physical symptoms including “Tired eyes”, “Stiff shoulders”, “Lethargy” and “Easily breaking into a sweat” and mental symptoms including “Loss of motivation”, “Shallow sleep” and “Difficulty falling asleep” for the Anti-Aging QOL Common Interview Sheet and in “Lifestyle” in terms of sleeping hours.

The results of the clinical laboratory tests did not show any dramatic changes which might have been directly related to the use of the TEST PRODUCT. The slight decrease in AST, γ -GTP and LDH seems to indicate the improvement of liver function, although the subjects in Study Group increased the frequency of alcohol intake. However, the use of the TEST PRODUCT increased the blood cortisol levels, which indicates an increase in stress levels. It is possible to say that the newly changed test mat put stress on.

Furthermore, any aging related changes in the subjects directly attributable to the use of the TEST PRODUCT for four weeks were not observed. Although the blood levels of DHEA-s and IGF-I secretion, which are said to decrease with advancing

age, were significantly decreased after use of the TEST PRODUCT. However, there were no clear indications as to why this occurred. Because the level of IGF-I decreased in both groups, it may have been due to differences in the test conditions. The observation that the urinary levels of 8-OHdG/CRE, an oxidization marker which is related to genetic damage, significantly decreased suggests possible improvement or betterment of the subjects' anti-oxidization abilities. Improvement in the quality of sleep may prompt the secretion of melatonin, an anti-oxidization substance. This should be explored further in the future.

References

- 1) Yonei Y, Mizuno Y. The human dock of tomorrow –Annual health checkup for anti-aging–. *Ningen Dock* 19:5-8, 2005.
- 2) Yonei Y, Iwaita Y, Muramatsu K, Mizuno Y. The anti-aging secrets of Japanese executives. *Anti-Aging Medical Research* 2:61-69, 2005.
- 3) Yonei Y, Mizuno Y, Kido M, Kaku L, Yasuda H. Research on toxic metal levels in scalp hair of the Japanese. *Anti-Aging Medical Research* 2:11-20, 2005.
- 4) Bando H, Yoshioka T, Yonei Y, Nakamura T. Investigation of quality of life in athletes from an anti-aging perspective. *Primary Care Jpn* 4:47-51, 2006.
- 5) Yonei Y, Mizuno Y, Togari H, Sato Y. Muscular resistance training using applied pressure and its effects on the promotion of growth hormone secretion. *Anti-Aging Medical Research* 1:13-27, 2004.
- 6) Yonei Y, Mizuno Y, Katagiri E. Effects of cosmetics therapy using isoflavone and pine bark extract on the skin and QOL: A double-blind placebo-controlled trial. *Anti-Aging Medical Research* 1:48-58, 2004.
- 7) Doi Y, Minowa M, Uchiyama M, Okawa M, Kim K, Shibui K, Kamei Y. Psychometric assessment of subjective sleep quality using the Japanese version of the Pittsburgh Sleep Quality Index (PSQI-J) in psychiatric disordered and control subjects. *Psychiatric Research* 97:165-172, 2000.
- 8) Floyd RA, Watson JJ, Wong PK, Altmiller DH, Rickard RC. Hydroxyl free radical adduct of deoxyguanosine: sensitive detection and mechanisms of formation. *Free Radic Res Commun* 1:163-172, 1986.
- 9) Toyokuni S, Tanaka T, Hattori Y, Nishiyama Y, Yoshida A, Uchida K, Hiai H, Ochi H, Osawa T. Quantitative immunohistochemical determination of 8-hydroxy-2'-deoxyguanosine by a monoclonal antibody N45.1: its application to ferric nitrilotriacetate-induced renal carcinogenesis model. *Lab Invest* 76:365-374, 1997.
- 10) Morrow JD, Awad JA, Kato T, Takahashi K, Badr KF, Roberts LJ 2nd, Burk RF. Formation of novel non-cyclooxygenase-derived prostanoids (F2-isoprostanes) in carbon tetrachloride hepatotoxicity. An animal model of lipid peroxidation. *J Clin Invest* 90:2502-2507, 1992.
- 11) Milne GL, Morrow JD. Isoprostanes and related compounds: update 2006. *Antioxid Redox Signal* 8:1379-1384, 2006.
- 12) Okamoto K, Iizuka S, Okudaira N. The effects of air mattress upon sleep and bed climate. *Appl Human Sci* 16:97-102, 1997.
- 13) Bader GG, Engdal S. The influence of bed firmness on sleep quality. *Appl Ergon* 31:487-497, 2000.
- 14) Enck P, Walten T, Traue HC. Associations between back pain, quality of sleep and quality of mattresses. Double-blind pilot study with hotel guests. *Schmerz* 13:205-207, 1999.
- 15) Monsein M, Corbin TP, Culliton PD, Merz D, Schuck EA. Short-term outcomes of chronic back pain patients on an airbed vs spring mattresses. *Med Gen Med* 2:E36, 2000.
- 16) Jacobson BH, Gemmell HA, Hayes BM, Altena TS. Effectiveness of a selected bedding system on quality of sleep, low back pain, shoulder pain, and spine stiffness. *J Manipulative Physiol Ther* 25:88-92, 2002.
- 17) Price P, Rees-Mathews S, Tebble N, Camilleri J. The use of a new overlay mattress in patients with chronic pain: impact on sleep and self-reported pain. *Clin Rehabil* 17:488-492, 2003.