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A Study on the Effects of Turmeric Intake after Weight Training on Blood Alcohol Concentration[1]

[1] Jun-Su KIM, [2] Young-Chul KIM
1. First Author, Assist Professor Dept, Outdoor Sports Eulji University, Korea, E-mail: kim2019@eulji.ac.kr
2. Corresponding Author Dept. Sport Tourism Convergence Eulji University, Korea, E-mail: youngchul071@naver.com

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Abstract

The purpose of this study was to investigate the effects of turmeric intake and weight training on blood alcohol concentration, liver enzyme levels of and their effects on health promotion in adult males. There was no significant difference of taking turmeric powder combined with weight training exercise on blood alcohol levels in adult men who consumed alcohol on a regular basis. There was also no change on the change of body composition. The results were collected from elite athletes that had spent more than 10 years in their respective sports so it is difficult to observe any significant results from 8 weeks, short-term exercises of 1RM 70~80%, 3 times per week. In the next study, it is necessary to divide the subjects into more diverse groups and subject them by varying amounts of turmeric intake, exercise, etc., in order to fully study and understand the effects on blood alcohol level, change, and health promotion. Consequently, this study demonstrated there were no significant differences in the effects of continuous drinking habits of adult men's turmeric powder intake and weight training exercise on changes in GOT, GPT, γ-GTP, and blood alcohol concentrations. Moreover, health improvements themselves didn't affect changes in body composition.

Keywords: Weight Training, Blood Alcohol Level, Turmeric, Alcohol

Major classifications: Health Science

1. Introduction

The alcohol consumption population in South Korea is increasing every year. Due to COVID-19, the food market ecosystem is rapidly transitioning from offline to online customer loyalty (Lee, Kwak, & Cha, 2020; Cha & Rha, 2021; Cha & Shin, 2021) as well. The annual drinking consumption rate of Korean people is 78.5%, which is more than half of the population and has been consistently high for 5 years, with 86.6% for men and 70.8% for women. Drinking causes social problems and disrupts social order, along with physical, mental, and social damage. Constant and excessive drinking causes family

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dissolution, unemployment and workplace problems, crime, and financial issues (Casswell & Thamarangsi, 2009), leading to tremendous social problems. It is important to discharge alcohol that accumulates in the body and has a harmful effect on the human body more quickly, because the body usually recovers 48 hours after alcohol intake. For people with declined liver functions, it is reported that aerobic exercises such as fast walking, jogging, hiking, swimming, etc., increase the body's resistance and recovery from diseases and effectively prevent fatty liver. Exercise is also effective for improving fatty liver.

It has been reported that aerobic exercise after alcohol intake promotes alcohol metabolism through a large amount of breathing and sweat, discharging alcohol out of the body. Nonetheless, there are not enough experimental studies on the liver function enzyme activity of alcohol and alcohol detoxification through anerobic exercise, i.e., weight training, instead of aerobic exercise.

Known to be effective in liver disease, turmeric is a perennial herbaceous plant belonging to the Cardamom family and has been effectively used in China for centuries to treat liver disease (Xu et al., 2005). Curcumin, the main medicinal property of turmeric, is known to have anti-cancer, antioxidant, and anti-inflammatory effects, improve detoxification and liver function, and have anti-viral and anti-angiogenic effects related to cancer cell proliferation. Curcumin has an inhibitory effect on squalene synthase, which is involved in the biosynthesis of cholesterol, and on liver cholesterol (Aggarwal, Surh, & Shishodia, 2007; Ryu, Han, & Jang, 2005; Ammon, & Wahl, 1991; Mazumder et al., 1995). However, in spite of the various functions of turmeric and curcumin, there is a lack of prior research showing that turmeric powder consumption significantly improves health by enhancing body composition and liver function.

Thus, this study aims to scientifically verify that turmeric powder intake and weight training exercise enhance health by improving the alcohol decomposition ability and body composition in adult men. It will also clarify how the turmeric powder intake affects the reduction of blood alcohol concentration and liver function enzymes.

2. Research Method

2.1. Research Subjects

For study subjects, this study recruited males in their 30s to 40s who consumed alcohol two to three times a week and have not been diagnosed with liver disease within the last 1 year. After thoroughly explaining the research details and purpose, experiment procedure, human rights protection, and all information related to the research, this study chose 12 adult males as subjects who understood the purpose of this study and voluntarily agreed and signed up to participate. Table 1 shows the physical characteristics of the study subjects.

Table 1: Physical characteristics of the Experimental subjects

Item	No. of subjects (n)	Age (Yrs)	Height (Cm)	Weight (Kg)
WTCG	6	34.66 ± 2.50	183.45 ± 3.13	95.25 ± 16.58
CONG	6	37.33 ± 7.08	184.45 ± 9.13	104.5 ± 19.41

Mean ±SD

2.2. Research Design

The selected subjects were randomly assigned into of the WTCG (Weight Training Curcumin Group) of 6 subjects who did weight training exercise and turmeric powder intake as well as the CONG (Control Group) of 6 subjects who only consumed turmeric powder without weight training exercise. Each group received a body composition test (height, weight, BMI, body fat percentage, lean mass), blood test (GOT, GPT, γ-GTP, blood alcohol concentration), and 1RM test (total of 24 weight training items) beforehand. For 8 weeks, the WTCG did weight training exercise and consumed turmeric powder for 90 minutes three times a week, and the CONG consumed only turmeric powder three times a week. In addition, after serving snacks (200g of raw meat and 300g of pork belly), this study recorded the amount of the subjects' alcohol intake by applying the Widmark formula twice a week Table 2.

Table 2: Widmark formula (Watson, Watson, & Batt, 1981)

C = A/ (P*R*10) = Maximum value of blood alcohol concentration (%)

A = Amount of alcohol intake (drinking amount * alcohol concentration * 0.7894 * in vivo absorption rate)

P = Weight (kg)

R = Coefficient for gender (males 0.86, females 0.64)

In vivo absorption rate = 0.7

▲ C (maximum value of blood alcohol concentration %) = A/ (P*R*10)

▲ Intake amount (ml) = (C*P*R*10)/ (alcohol concentration*0.7894*0.7)

2.3. Experiment Equipment

To achieve the research purpose, this study used the weight training machines and free weight machines of SCINOT (Kor) as the exercise equipment of the training group.

2.4. Measurement Items and Method

2.4.1. Blood collection

The researcher had a nurse collect 6mL of each subject's blood sample before and after training for 8 weeks. The experimenters collected 6mL of blood from the antecubital vein and put it in a vacuum blood collection tube (K90313, Green Cross MS, Korea), coated with EDTA to prevent blood clotting, to obtain plasma sample. To mix it completely, the blood samples of both subject groups were shaken 8-10 times slowly and then were centrifuged at 3,000 rpm for 10 minutes using a centrifuge (HA-1000-3, Hanil Industries, Korea).

2.4.2. Body composition test

The subjects' body compositions including the height, weight, body fat percentage, BMI, lean mass, and muscle mass were measured using Inbody720 (Bio-space), twice in total before and after the 8-week exercise experiment. The measurement procedure is as follows. The study subjects were made to refrain from vigorous physical activities and rapid lifestyle changes for 48 hours before the measurement and they maintained the fasting state for 12 hours or longer. Wearing light clothes and standing in a stable state, the subjects entered personal information on the body composition equipment, stood on the foot electrode plate, and held the hand electrode plate for about one minute with their arms open. Their Body Mass Index, Fat Free Mass, and Muscle Mass were measured.

2.4.3. Liver function enzymes

(1) GOT (Glutamic Oxaloacetic Transaminase)

GOT was measured by the enzyme activity assay (reagent conforming to IFCC recommendation). The test reagent was Aspartate Aminotransferase acc. To IFCC, and the test equipment used was Roche Cobas c702. As for the test principle, AST promotes the transport of amino groups between L-aspartate 2-oxoglutarate to form oxaloacetate and L-glutamate. Oxaloacetate reacts with NADH to form NAD+ through MDH (malate dehydrogenase). The oxidation rate of NADH is directly proportional to the AST catalysis and is evaluated by measuring the reduced absorbance. The reference intervals are 0~40 IU/L.

(2) GPT (Glutamate Pyruvate Transaminase)

GPT was measured by the enzyme activity assay (reagent conforming to IFCC recommendation). The test reagent used was Aspartate Aminotransferase acc. To IFCC, and the test equipment was Roche Cobas c702. As for the test principle, ALT promotes the reaction between L-aspartate 2-oxoglutarate. Pyruvate, which was formed by the catalysis of LDH lactate dehydrogenase to generate L-lactate and NAD+, is reduced by NADH. The oxidation rate of NADH is directly proportional to the ALT catalysis and is evaluated by measuring the reduced absorbance. The reference intervals are 0~45 IU/L.

(3) γ-GTP (Gamma Glutamyl Transpeptidase)

γ-GTP was measured by the enzyme activity assay (reagent conforming to IFCC recommendation). The test reagent used was γ-glutamyltransferase ver.2, and the test equipment was Roche Cobas c702. As for the test principle, γ-glutamyltransferase transfers the γ-glutamyl group of L-γ-glutamyl-3-carboxy-4-nitroanilide to glycylglycine. The amount of free 5-amino-2-nitrobenzoate is proportional to the GGT activity of the reagent, and is evaluated by measuring the increased absorbance. The reference intervals are 0~67 IU/L.

2.4.4. Analysis of blood alcohol concentration

Blood alcohol concentration was measured by the enzyme activity assay (reagent conforming to enzymatic recommendation), and the test equipment used in this study was Roche Integra 800, and the test reagent was COBAS INTEGRA ETOH GEN.2. The test principle is the enzymatic method using alcohol dehydrogenase, which converts ethyl alcohol and NAD to acetaldehyde. NADH formed during the reaction is measured by the rate of change in absorbance, which is directly proportional to the ethyl alcohol concentration and measures the increased absorbance. Reference intervals are <10.0mg/dL.

2.5. Experiment Method

This study recruited 12 males who work at Company E in Seoul, consume alcohol 2-3 times a week and who have not been diagnosed with liver disease within the last 1 year, understood the purpose of the research, and voluntarily agree to participate. The study subjects were randomly assigned into the turmeric powder intake group (CONG) of 6 people and the weight training and turmeric powder intake group (WTCG) of 6 people. Before the experiment, they took the body composition test, blood test, and 1RM. The 8-week experiment was applied 3 times per week for 90 minutes every Monday, Wednesday, and Friday. Both the weight training and turmeric powder intake group (WTCG) and the turmeric powder intake group (CONG) consumed 2-3g of Indian turmeric powder mixed in water on Monday, Wednesday, and Friday mornings and did not consume any health or exercise supplements at all other than turmeric powder. Both groups drank alcohol twice a week on Tuesdays and Thursdays with a certain amount of snacks (200g of raw meat and 300g of bork belly) within 2 hours per serving Table 3.

Table 3: T-test for Alcohol intake

Item	Number of subjects (n)	Weight	Intake amount	T	DF	P
WTCG	6	95.25 ± 16.58	728.83 ± 142.77			
CONG	6	104.50 ± 19.41	771.83 ± 133.66	-.539	9.957	.602
Variance is not assumed						

2.6. Data Processing

The data collected through this study was analyzed using the SPSS 28.0 statistical program, and all variables were expressed as mean (M) and standard deviation (SD). Repeated two-way ANOVA was performed for the experiment type and the pre-post variable changes. If the significance of each item was recognized, this study conducted post-mortem verification by applying the Duncan analysis method. All statistical significance levels (α) were set to 0.05.

3. Research Results

3.1. Liver Function Enzyme

3.1.1. GOT

Among the changes in liver function enzyme by group, GOT decreased from 33.16 IU/L to 27.00 IU/L in the turmeric powder intake and weight training group, and from 32.33 IU/L to 29.00 IU/L in the turmeric powder intake group. A repeated measurement two-way ANOVA was conducted to verify the average difference of GOT changes by group, which showed that there was no significant difference in the main effect of the group (p>.05) but there was a main effect of the period (p<.05).

Table 4: Changes in factors before and after exercise program

Group		N	Before	After	
			Mean ±SD	Mean ±SD	
GOT	WTCG	6	33.16 ±11.25	27.00 ±10.00	Group = .903 Time = .039 Group*Time = .495
	CONG	6	32.33 ±5.31	29.00 ±7.56	
	WTCG	6	30.17 ± 9.79	22.00 ± 9.72	Group = .018

GPT	CONG	6	52.00 ± 17.71	38.50 ± 14.57	Time = .016 Group*Time = .495
γ-GTP	WTCG	6	36.50 ± 14.98	27.17 ± 10.91	Group = .849 Time = .014 Group*Time = .980
	CONG	6	38.00 ± 17.71	28.50 ± 9.94	
Blood alcohol level	WTCG	6	1.93 ± 1.67	0.27 ±0.27	Group = .798 Time = .004 Group*Time = .805
	CONG	6	1.71 ± 1.13	0.26 ±0.23	
Weight	WTCG	6	95.25 ±16.58	95.56 ±17.72	Group = .449 Time = .317 Group*Time = .148
	CONG	6	104.50 ±19.41	102.88 ±19.05	
Body fat rate	WTCG	6	23.61 ±4.55	22.58 ±5.25	Group = .709 Time = .252 Group*Time = .656
	CONG	6	24.31 ±4.42	23.85 ±3.92	
BMI	WTCG	6	28.31 ±4.42	28.40 ±4.77	Group = .469 Time = .832 Group*Time = .832
	CONG	6	30.11 ±3.49	30.11 ±3.26	
Lean body mass	WTCG	6	72.13 ±7.87	73.23 ±8.17	Group = .359 Time = .255 Group*Time = .465
	CONG	6	78.13 ±12.57	78.38 ±11.00	
Muscle mass	WTCG	6	66.63 ±6.97	67.73 ±6.97	Group = .353 Time = .833 Group*Time = .076
	CONG	6	72.73 ±10.63	71.85 ±10.93	

3.1.2. GPT

Among the changes in liver function enzyme by group, GPT decreased from 30.17U/L to 22.00IU/L in the turmeric powder intake and weight training group and from 52.00IU/L to 38.50IU/L in the turmeric powder intake group before and after the experiment as seen in Table 10, Figure 3, before and after the experiment. Repeated measurement two-way ANOVA was performed to verify the average difference of GPT changes by group and showed that there was a significant difference in the main effect of the group ($p<.05$) and there was a main effect of the period ($p<.05$) as seen in Table 11.

3.1.3. γ-GTP

Among the changes in liver function enzyme by group, γ-GTP decreased from 36.50U/L to 27.17IU/L in the turmeric powder intake and weight training group and from 38.00IU/L to 28.50IU/L in the turmeric powder intake group as seen in Table 12, Figure 4, before and after the experiment. Repeated measurement two-way ANOVA was performed to verify the average difference of GPT changes by group and showed that there was no significant difference in the main effect of the group ($p>.05$) but there was a main effect of the period ($p<.05$) as seen in Table 13.

3.2. Blood alcohol concentration

The blood alcohol concentration decreased from 1.93mg/dL to 0.27mg/dL in the turmeric powder intake and weight training group and from 1.71mg/dL to 0.26mg/dL in the turmeric powder intake group as seen in Table 14, Figure 5, before and after the experiment. Repeated measurement two-way ANOVA was performed to verify the average difference of blood alcohol concentration change by group, and it showed that there was no main effect in the group but there was a main effect of the period ($p<.05$) as seen in Table 15.

3.3. Body Composition

3.3.1. Weight

Body weight increased from 95.25kg to 95.56kg in the turmeric powder intake and weight training group and decreased from 104.50kg to 102.88kg in the turmeric powder intake group as seen in Table 16, Figure 7, before and after the experiment. Repeated measurement two-way ANOVA was performed to verify the average difference of weight change by group, which demonstrated that there was no main effect in the group and the period ($p>.05$) as seen in Table 1.

3.3.2. Body fat percentage

The body fat percentage increased from 23.61% to 22.58% in the turmeric powder intake and weight training group and decreased from 24.31% to 23.85% in the turmeric powder intake group as seen in Table 18, Figure 7, before and after the experiment. Repeated measurement two-way ANOVA was performed to verify the average difference of body fat percentage change by group, which demonstrated that there was no main effect in the group and the period ($p>.05$) as seen in Table 19.

3.3.3. BMI

While the BMI increased from 28.31kg/m2 to 28.40kg/m2 in the turmeric powder intake and weight training group, it remained at 30.11kg/m2 and no change for the turmeric powder intake group as seen in Table 20, Figure 8, before and after the experiment. Repeated measurement two-way ANOVA was performed to verify the average difference of BMI change by group, which demonstrated that there was no main effect in the group and the period ($p>.05$) as seen in Table 21.

3.3.4. Lean mass

As shown in Table 22, Figure 9, lean mass increased from 72.1kg to 73.23kg in the turmeric powder intake and weight training group and from 78.13kg to 78.38kg in the turmeric powder intake group, before and after the experiment. Repeated measurement two-way ANOVA was performed to verify the average difference of lean mass change by group, which showed no main effect in the group and period ($p>.05$) as in Table 23.

3.3.5. Muscle Weight

As shown in Table 24, Figure 10, muscle weight increased from 66.63kg to 67.73kg in the turmeric powder intake and weight training group but it decreased from 72.73kg to 71.85kg in the turmeric powder intake group, before and after the experiment. Repeated measurement two-way ANOVA was performed to verify the average difference of muscle weight change by group, which demonstrated that there was no main effect in the group and the period ($p>.05$) as seen in Table 25.

4. Discussions

After alcohol intake, people experience hangovers in the process of decomposition, treatment, and discharge of alcohol. With higher social interest in numerous alcohol-related diseases brought by alcohol intake, interest in relieving hangovers is also increasing greatly. However, the measures for relieving hangovers are inevitably limited for the people of modern society who need to continue their professional social and economic activities.

4.1. Liver Function Enzyme (GOT, GPT, γ-GTP)

It is reported that GOT and GPT are transfer enzymes involved in amino acid metabolism. GOT is mainly distributed in the order of heart, liver, skeletal and kidney, while GPT is an enzyme that mainly exists in liver cells and reflects the degree of necrosis and destruction of liver cells; it is also recently also known as aspartate aminotransferase (AST; GOT) and alanine aminotransferase (ALT; GPT). The activity of the transfer enzymes increases their release into blood due to disorders of liver parenchymal cells caused by high fat diet or alcohol, consumption, and their continuous excess can cause serious diseases in bone, liver, biliary tract, and malignant tumors.

In addition, γ-GTP is an enzyme that catalyzes the transfer of γ-glutamine groups to other peptides or L-amino acids. Clinically, it increases in serum due to liver disease, obstructive jaundice, alcoholic liver disorder, hepatitis, liver cirrhosis, and liver cancer, and it especially reacts sensitively to alcohol and shows abnormal values faster than other enzymes if there is a liver or biliary tract disease (Friedman, 1990).

4.1.1. Changes in GOT

This study derived results through a two-way repeated ANOVA on office workers in their 30-40s who had constant alcohol consumption, after they took turmeric powder and weight training exercise. The GOT level was not significantly different between the turmeric powder intake group and the turmeric powder intake and weight training group, but it decreased for both groups after 8 weeks of experiment.

4.1.2. Changes in GPT

This study derived results through a two-way repeated ANOVA on office workers in their 30-40s who had constant alcohol consumption, after they took turmeric powder and weight training exercise. GPT level had no interaction effect between the turmeric powder intake group and the turmeric powder intake and weight training group, but it showed a significant effect for both groups and the level decreased after 8 weeks of the experiment.

4.1.3. Changes in γ-GTP

This study derived results through a two-way repeated ANOVA on office workers in their 30-40s who had constant alcohol consumption, after they took turmeric powder and weight training exercise. The γ-GTP level had no significant difference between the turmeric powder intake group and the turmeric powder intake and weight training group, but the level decreased for both groups after 8 weeks of experiment. The analysis of the changes in the levels of liver function enzymes GOT, GPT, and γ-GTP at each measurement point showed that turmeric powder intake and weight training were effective in stabilizing and lowering the liver enzyme levels.

4.2. Changes in blood alcohol concentration (BAC)

This study seeks to discuss the changes in blood alcohol concentration after applying turmeric powder intake and weight training to office workers in their 30s to 40s who constantly drink alcohol. A two-way repeated ANOVA was conducted on office workers in their 30s and 40s who constantly drink alcohol after their turmeric powder intake and application of weight training exercise. According to the result, blood alcohol concentration level was not significantly different between the turmeric powder intake group and the turmeric powder intake and weight training group, but the concentration level for both groups decreased after 8 weeks of experiment.

4.3. Changes in Body Composition

This study derived the results through a two-way repeated ANOVA by applying turmeric powder intake and weight training exercise to office workers in their 30s to 40s who constantly drink alcohol. Although there was no significant difference in the weight for all results, the weight decreased in the turmeric powder intake group after 8 weeks of experiment and increased slightly in the turmeric powder intake and weight training group. There was no significant difference in body fat percentage for all results, but it decreased for both the turmeric powder intake group and the turmeric powder intake and weight training group after 8 weeks of experiment. In addition, there was no significant difference in BMI for all results, but after 8 weeks of experiment, it increased slightly for the group with turmeric intake and weight training and did not change for turmeric powder intake group. Next, there was no significant difference in lean body mass to all results, but after 8 weeks of experiment, it increased slightly for both the turmeric intake group and the turmeric intake and weight training group. Muscle mass did not have any significant difference in all results, and after 8 weeks of experiment, it increased for the turmeric powder intake and weight training group but decreased for the turmeric powder intake group. These results are because the research subjects in this experiment are composed of former sports elites and athletes who used to play in sports events for more than 10 years in the past, so it is difficult to bring significant changes to their body compositions through a short-term 8-week exercises conducted 3 times a week.

5. Conclusion

GOT did not show any inter-group interaction effect and had no significant difference in the main effect of the group, but there was a significant difference in the measurement period between both the turmeric powder intake and weight training group and the turmeric powder intake group ($p<.05$). GPT did not have inter-group interaction effect, but there were significant differences in the main effects of the turmeric powder intake and weight training group and the turmeric powder intake group ($p<.05$). Also, there was a significant difference between the two groups in the measurement period ($p<.05$). γ-GTP did not show any inter-group interaction effect and had no significant difference in the main effects of the turmeric powder intake and weight training group and the turmeric powder intake group, but there was a significant difference between the two groups ($p. <.05$). Changes in blood alcohol concentration did not show any inter-group interaction effect, and there was no significant difference in the main effects of the turmeric powder intake and weight training group and the turmeric powder intake group, but there was a significant difference in the measurement period ($p< .05$). Also, changes in body composition were not

significantly different in all the results of the turmeric powder intake and weight training group and the turmeric powder intake group (p>.05).

In conclusion, this study verified that there was no difference in the effects of turmeric powder intake and weight training exercise on changes in GOT, GPT, γ-GTP and blood alcohol concentration in adult men who consumed alcohol continuously. Health improvement had no effect on changes in body composition as well.

6. Implications

As described above, the effects of turmeric powder intake and weight training on blood alcohol concentration, liver function enzymes GOT, GPT, γ-GTP, and health promotion in adult men who constantly drink alcohol were confirmed. The investigation was conducted with only male subjects composed of athletes in their 30s to 40s who are currently employed by Company E, and for this reason, all subjects could not be represented. Therefore, the following limitations and future research tasks are presented.

First, there should be an in-depth study by dividing the subject of research into men's, women's, and other age groups. Second, it did not reflect whether the subjects of the study had a strong constitution for drinking. However, since only their weight was considered. Therefore, future research should take into account the amount of alcohol consumed by the individual. Third, the research subjects' normal eating habits could not be controlled, so future research should consider this concern.

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