KOREAN FERMENTED FOOD

2020.06.10
CJ FOOD RESEARCH INSTITUTE
AGENDA

PART 1. INTRODUCTION

PART 2. EFFECT ON HEALTH BENEFIT

PART 3. CONCLUSION
INTRODUCTION

INGREDIENTS
Kimchi cabbage, Red pepper powder, Radish, Garlic, Ginger, Mustard leaf, Onion, Fermented fish sauce etc.

PROBIOTICS & BIOACTIVE COMPOUNDS
Lactobacillus plantarum, Lac. brevis, Leu. citreum Leu. mesenteroides, Weissella koreensis Vitamines, Fiber, Phytochemicals
INTRODUCTION

INGREDIENTS
Soybean, Rice, Wheat, Red pepper powder, Sea salt

MICROBES
Aspergillus sp., Bacillus sp.,

BIOACTIVE COMPOUNDS
Isoflavones(genistein, daidzein etc), Flavonoids, Soyasaponins, Alkaloids(capsaicin)
In both groups (fresh and fermented kimchi), significant decreases in body weight, BMI, and body fat were observed.

The fermented kimchi group showed a significant decrease in the WHR, fasting blood glucose, and total cholesterol.

The ingestion of fermented kimchi had positive effects on various factors associated with metabolic syndrome.

Twenty-two overweight and obese patients with BMI greater than 25 kg/m² were randomly assigned to two 4-week diet phases separated by a 2-week washout period (crossover design).
EFFECT ON HEALTH BENEFIT

DIETARY PREVENTION OF HELICOBACTER PYLORI-ASSOCIATED GASTRIC CANCER WITH KIMCHI

- The scattered modular masses, some ulcers and thin nodular gastric mucosa were noted in H. pylori-infected mice, whereas these gross lesions were significantly attenuated in Kimchi group.
- The expressions of COX-2 and IL-6 were all significantly attenuated in Kimchi group.

* Daily dietary intake of Kimchi can be an effective way either to rejuvenate H. pylori-atrophic gastritis or to prevent tumorigenesis supported with the concerted action of anti-oxidative, anti-inflammatory and anti-mutagenic mechanisms.
Dietary intake of probiotic Kimchi ameliorated IL-6-driven cancer cachexia

1. Dietary intake of Kimchi significantly attenuated the development of cancer cachexia, resented with lesser weight loss, higher muscle preservation as well as higher survival from cancer cachexia in mice.
2. The expressions of IL-6, muscle specific ubiquitin–proteasome system including of atrogin-1 and muscle wing finger protein-1 (MuRF-1) with other muscle related genes Mfn-2 were all significantly attenuated in Kimchi.

→ Daily dietary intake of Kimchi can be an anticipating option to ameliorate cancer cachexia via suppressive action of IL-6 accompanied with decreased muscle atrophy and lipolysis.

DOENJANG, a KOREAN SOYBEAN PASTE, AMELIORATES TNBS-INDUCED COLITIS IN MICE BY SUPPRESSING GUT MICROBIAL LIPOPOLYSACCHARIDE PRODUCTION AND NF-κB ACTIVATION

- Oral administration of doenjang significantly inhibited TNBS-induced colon shortening, myeloperoxidase activity, body weight loss, and NF-κB activation in mice.
- Doenjang reversed the TNBS-caused suppression of tight junction proteins.
- Doenjang also inhibited TNBS-induced expression of inducible nitric oxide synthase, cyclooxygenase-2, TNF-α, IL-1β, IL-6 and activation of NF-κB but increased IL-10 expression.

* Doenjang may ameliorate colitis by inhibiting NF-κB signaling pathway.

※ (T) TNBS alone treated group, (TD) Doenjang-treated group with TNBS, (N) Normal group

Diets containing doenjang test agents were treated for 7 days after TNBS treatment.

Doenjang, a Korean traditional fermented soybean paste, ameliorates neuroinflammation and neurodegeneration in mice fed a high-fat diet.

- Doenjang consumption alleviated hippocampal neuronal loss, which was increased by the HF diet. The cell proliferation and neurotrophic factor mRNA levels were higher in the DJ (doenjang) group.
- Contents of oxidative metabolites and mRNA levels of oxidative stress and neuroinflammation-related genes were lower in the DJ group compared to the HF group.

* Doenjang was more effective than steamed soybean in suppressing neuroinflammation and neurodegeneration in mice.

※ ((LF) low-fat diet, (HF) high fat diet, (SS) HF-containing steamed soybean diet, (DJ) HF-containing doenjang

J.W. Ko et al. / Nutrients 2019, 11, 1702
EFFECT ON HEALTH BENEFIT

EFFECT OF FERMENTED SOYBEAN PRODUCTS INTAKE ON THE OVERALL IMMUNE SAFETY AND FUNCTION IN MICE

- No significant alterations were observed in peripheral or splenic immune cells among groups. Enhanced splenic natural killer cell activity was observed in the DJ and CGJ groups compared with the plain diet group.
- Th1-mediated immune response were enhanced in the DJ and CGJ groups with an upregulated production ratio of IFN-γ vs. IL-4 and IgG2a vs. IgG1 in stimulated splenic T and B cell, respectively.

> *Doenjang and Cheonggukjang intake consolidates humoral and cellular immunity to Th1 responses.*

Table 2. Average number of peripheral blood cells (mean ± SEM) in the groups of mice (n = 8)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>DJ</th>
<th>CCJ</th>
<th>Unfermented</th>
<th>Plain</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBCs (10^3/μL)</td>
<td>4.40 ± 0.92</td>
<td>4.17 ± 1.18</td>
<td>4.42 ± 0.74</td>
<td>5.37 ± 0.70</td>
</tr>
<tr>
<td>RBCs (10^6/μL)</td>
<td>11.04 ± 0.44</td>
<td>10.19 ± 0.43</td>
<td>10.13 ± 0.54</td>
<td>10.15 ± 0.10</td>
</tr>
<tr>
<td>Platelets (10^3/μL)</td>
<td>804.7 ± 136.4</td>
<td>672.6 ± 139.0</td>
<td>759.6 ± 126.2</td>
<td>743.2 ± 88.1</td>
</tr>
<tr>
<td>Neutrophils (10^3/μL)</td>
<td>1.29 ± 0.49</td>
<td>0.71 ± 0.18</td>
<td>0.63 ± 0.11</td>
<td>1.33 ± 0.22</td>
</tr>
<tr>
<td>Lymphocytes (10^3/μL)</td>
<td>2.76 ± 0.59</td>
<td>3.12 ± 0.91</td>
<td>3.51 ± 0.64</td>
<td>3.71 ± 0.76</td>
</tr>
<tr>
<td>Monocytes (10^3/μL)</td>
<td>0.06 ± 0.01</td>
<td>0.05 ± 0.02</td>
<td>0.07 ± 0.02</td>
<td>0.07 ± 0.01</td>
</tr>
<tr>
<td>Eosinophils (10^3/μL)</td>
<td>0.10 ± 0.03</td>
<td>0.11 ± 0.05</td>
<td>0.09 ± 0.02</td>
<td>0.09 ± 0.02</td>
</tr>
<tr>
<td>Basophils (10^3/μL)</td>
<td>0.02 ± 0.01</td>
<td>0.03 ± 0.02</td>
<td>0.02 ± 0.01</td>
<td>0.02 ± 0.01</td>
</tr>
</tbody>
</table>

Table 3. Distribution of IgG isotypes (mean ± SEM) in serum or B cell culture supernatants of mice

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Group</th>
<th>IgE (ng/mL)</th>
<th>IgG2a (ng/mL)</th>
<th>IgG1 (ng/mL)</th>
<th>IgG2a/IgG1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum</td>
<td>DJ</td>
<td>316.5 ± 36.1</td>
<td>0.899 ± 0.069</td>
<td>0.391 ± 0.063</td>
<td>2.57 ± 0.31</td>
</tr>
<tr>
<td></td>
<td>CCJ</td>
<td>349.6 ± 59.7</td>
<td>0.795 ± 0.043</td>
<td>0.225 ± 0.013</td>
<td>3.61 ± 0.28</td>
</tr>
<tr>
<td></td>
<td>Unfermented</td>
<td>357.2 ± 51.9</td>
<td>0.753 ± 0.067</td>
<td>0.290 ± 0.026</td>
<td>2.53 ± 0.10</td>
</tr>
<tr>
<td></td>
<td>Plain</td>
<td>320.0 ± 55.3</td>
<td>0.562 ± 0.072</td>
<td>0.183 ± 0.021</td>
<td>3.10 ± 0.28</td>
</tr>
<tr>
<td>Culture supernatants</td>
<td>DJ</td>
<td>NT</td>
<td>227.8 ± 27.9</td>
<td>105.0 ± 6.7</td>
<td>2.14 ± 0.17</td>
</tr>
<tr>
<td></td>
<td>CCJ</td>
<td>NT</td>
<td>212.2 ± 30.4</td>
<td>103.1 ± 13.9</td>
<td>2.07 ± 0.10</td>
</tr>
<tr>
<td></td>
<td>Unfermented</td>
<td>NT</td>
<td>316.5 ± 46.8</td>
<td>118.1 ± 14.5</td>
<td>2.66 ± 0.22</td>
</tr>
<tr>
<td></td>
<td>Plain</td>
<td>NT</td>
<td>146.4 ± 31.5</td>
<td>112.8 ± 0.5</td>
<td>1.22 ± 0.18</td>
</tr>
</tbody>
</table>

A: [Graph A description]
B: [Graph B description]
C: [Graph C description]

J.H. Lee et al. / J Vet Sci 2017 18(1) 25-32
EFFECT ON HEALTH BENEFIT

FERMENTATIVE CHARACTERISTICS AND ANTIMUTAGENIC AND ANTICANCER EFFECTS OF SOONCHANG TRADITIONAL KOCHUJANGS

- Antimutagenic effects of the Kochujangs were studied against aflatoxin B1 (AFB1) and N-methyl-N’-nitro-N-nitrosoguanidine (MNNG) in Salmonella typhimurium TA100.
- Anticancer effects of the Kochujang were studied by inhibitory effect on the growth of AGS human gastric adenocarcinoma cells and HT-29 human colon cancer cells in MTT assay.

- The fermentation level and different preparation methods of the Kochujang were related with antimutagenic and anticancer activity.

※ Soonchang traditional Kochujangs (Shickhae, Bab and Deuk) were prepared with different kinds of manufacturing methods.
EFFECT ON HEALTH BENEFIT

GOCHUJANG PREPARED USING RICE AND WHEAT KOJI PARTIALLY ALLEVIATES HIGH–FAT DIET–INDUCED OBESITY IN RATS

- The levels of serum triglyceride(TG), total cholesterol, low–density lipoprotein cholesterol, and leptin were lower in all Gochujang group than in the HFD group.
- RG and WG treatment decreased the hepatic TG content and lipid accumulation and significantly reduced the size of epididymal adipocytes.

Anti–obesity effect may be attributed to secondary metabolites, such as capsaicin, genistein, daidzein, soyasaponin and lysophosphatidylcholines, contained in Gochujang prepared using rice and wheat koji.

※ RG(Rice gochujang), WG(wheat gochujang), HFD(high fat diet)
※ Histopathological analysis of the livers of rats fed experimental diets for 8 weeks
CONCLUSION

Fermented foods have undergone a surge in popularity, mainly due to their proposed health benefits.

Health Impact of Fermented Foods

- Contain potentially probiotics microorganisms
- Fermentation-derived metabolites may exert health benefits
- Convert certain compounds to biologically active metabolites

CONCLUSION

The microbial community living in the gastrointestinal tract of humans is essential for health. Disturbances of this community can lead to chronic diseases.

- Kimchi and Doenjang intake affected the formation of intestinal microbiota.
  - Fermented foods are shown to be beneficial as a healthy synbiotics.


Figure 1: Intestinal microbiota distribution at the phylum level for kimchi intake. Groups of 6 adult females each 15 g/day kimchi intake group (low) and 150 g/day kimchi intake group (high), analyzed the microbial distribution of total 12 women's feces samples by microarray of 16S rRNA gene amplicons; repeated 3 times per feces samples. Taxos is the average each group of 6 women's phylum level. Low: 15 g/day kimchi intake group, High: 150 g/day kimchi intake group.
Postbiotics are functional bioactive compounds, generated in a matrix during fermentation, which may be used to promote health.

- **What is a postbiotics?** Metabolites, SCFAs, Cell fractions, Functional proteins, EPS, Cell lysates, Inactivated probiotics
- **How do they work?** An integrated approach to microbiome-based therapeutics
- **Sources of Postbiotics?** Kimchi, Doenjang, Gochujang, Vinegar, Yourgt, Sauerkraut, Kefir, Tempeh etc.

* Food is the best medicine. Prevention rather than treatment, food is the best vehicle for health and wellness. Especially, fermented foods are postbiotics which boost probiotics activity.

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**Figure 1** | An integrated approach to microbiome-based therapeutics. Current generalized ‘one treatment fits all’ approaches (left panel) may suffer from limited efficacy due to an inability of the exogenous bacteria to colonize a host that harbours a discordant microbiome configuration, or from lack of targets for probiotics. Microbiome-modulated metabolites may surpass these limitations by exerting a beneficial host effect downstream of the microbiome, or by stabilizing the transferred microbial configurations (right panel). As such, metabolite treatment may enable an improved efficacy when coupled with other microbiome-based treatments, such as probiotics and nutritional interventions. All such approaches will be optimized when personally tailored to the individual’s physiology and microbiome configuration.

Ref: NATURE MICROBIOLOGY 2, 2017
THANK YOU