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Development and Product Quality of High Nutrition-Low Cost Supplementary Foods for the Children for Wonsecng County Comprehensive Nutritic n Program in Korea

— Part I : Formulation and production performance of Proposed Supplementary Foods —

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원성군 시범종합영양사업을 위한 어린이용 고영양보충식품의 개발에 관한 연구

— 제 1 보 : 제품의 조제 및 생산시험 —

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원성군 시범종합영양사업을 위한 어린이용 고영양 보충식품(HNLC Supplementary Foods)의 개발을 시도하였다.

MFM-KIST Extrusion Cooking System에 의한 일연의 실험결과, CSS-3, CSS-4 및 BSS-4 등의 제품이 영양학적, 식품가공학적 경제적 그리고 기호성등의 여러가지 면에서 바람직하였다. 특히 CSS-4 제품(기본 원료구성 : 옥수수가루 68%, 탈지대두분 20%, 참깨가루 2%, 옥수수 기름 4%, 설탕 4%, 식염 1%, 비타민, 무기질성분 및 첨가물 1%)은 영양강화 간편식품으로서 가공생산성 및 기호성이 가장 만족스러웠으나, 제품의 다양성 및 원료수급면을 고려하여 위 개발제품들을 모두 필요에 따라 활용할 수 있었다.

INTRODUCTION

A balanced nutrition is an indispensable factor in the supply of necessary manpower resources for the industrialization efforts of the nation as well as in improving public health and physique of individual people. The importance of balanced nutrition is one of the special emphasis on the growing children in view of its important bearing on the brain and body development[1)2)3)]. Along with the economic

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growth, it is to be admitted that the nutrition status of Korean people has been improved considerably for the past decade on the statistical figures of the per capita daily supply of calorie and protein. Such a trend of nutritional improvement was also reflected at the National nutrition survey[5] and Wonseong County nutrition survey[6] However, under the exiting dietary pattern, Korean heavily rely on the vegetable sources for the supply of daily foods. Another factor still posing a greater problem is the wide gap of income existing between urban and rural communities with the dietary standard of the low income brackets families falling far below the recommended level of nutrition[5][6][7].

Wonseong County, Kangwon Province, Korea is one of the typical area, nutrition of which falls considerably behind the recommended level of nutrients[6]. The problem is not only of Wonseong County people alone but represents an universal concern in all less-developed countries and this will inevitably indicate a positive effort for the development of low-cost food stuff of balanced nutritive values. On the other hand, except for the milk products most of the processed foods in the market we re prepared with a little nutritive considerations and distributed with a high price. Naturally, it may be generally termed either "tasteful food" than "nutritive food" and yet one conspicuous point is that they are generally pr iced comparatively on the high side. As seen from the foregoing point of view, existing processed food items are far from the concept of the so called low cost-high nutrition foods (LCHN Foods). This study is a part of the development of high nutrition-low cost foods for the project-Wonseong County Comprehensive Nutrition program which was assisted by local/national Government of Korea and Meals for Million (MFM) Foundation, USA[7].

In this study, various foodstuffs available in Korea were reviewed and selected for the formulation of high nutrition-low cost food mixtures as supplmentary foods with the consideration of calorie, protein, vitamin and minerac for the children in rural area. And then each formula of mixtures was examined for the evaluation of production performance with the MFM-KIST Extrusion Cooker system, which was developed by MFM and Korea Institute of Science and Technology (KIST).

EXPERIMENTAL METHODS

1. *Basic Consideration of Proposed Supplmentary Foods*

Based on the results of previous studies on the nutritional gap of Wonseong County[6] and also based on the PAG Guideline No. 8,[8] a nutritional criteria has been established for the target product to be developed, as follows: The target product should be composed of at least 16% protein, with net protein utilization (NPU) standing at 60 or over, and protein efficiency ratio (PER) at 2.1 or over (PER of casein is 2.5). Calorie, mineral and vitamin must be considered based on the finding of the previous studies on the nutritional status of target peoples in Wonseong County. Recommended price levels are to be lowered down to a half of the price of other commercial products in market. The sensory acceptability of product, such as flavor, taste, etc., is to be disregarded to certain extent in the interest of discrimination against other similarities of more tasteful or favorite nature. As for storage stability of product, the recommended

duration of shelf life is about one month without any changes of product flavor in ambient situation of summer weather in Korea.

2. *Major Materials for Proposed Formula*

Barley, corn and soybean constituted the three major cereals most recommended for proce ssing in Korea. Therefore, the desired formula of materials composition will be either barley soybean-others or corn-soybean-others, and if necessary in order to increase the protein content or to improve the protein quality, minor quantities of sesame or anchovy may preferably be blended in[9]. Accordingly barley, corn, soybean, sesame, powdered milk, peaunt, rice, wheat, etc. may also be considered as potential raw materials.

3. *Formulation Procedure*

Proposed supplementary products were developed by the following general approach: 1) Available low cost foodstuffs were tabulated for a relatively local area and their compositional makeup and cost obtained. 2) The essential amino acid components of the various ingredients were considered and various combinations of materials calculated which gave a balanced blend of essential amino acid[10] 3) Other nutritional considerations on the calorie vitamin and mineral were given to the development of formula. 4) And then, from laboratory mixing and formulation into desired products, several formula were selected and examined for production performance with MFM -KIST Extrusion Cooking System.

4. *Description of the Equipment and MFM-KIST Extrusion Cooking System for the Production*

Table 1 lists the main characterics of MFM -KIST extruder used for this study. MFM-KIST Extrusion Cooking System is outlined in Figure 1 and is now practiced in the production of snack foods, blended foods, textured vegatable protein and inactivation of enzymes[11].

Table 1. Characteristics of the MFM-KIST extruder

Characteristics	MFM-KIST Extruder
Capacity (Kg/hr)	100
Feeding System	Forced feeding
Screw configuration	Constant
Diameter screw(inch)	3
Relation L/D screw	10 : 1
Source of heat	Mechanical friction heat
Motor power (H.P.)	30
Product shape	Highly expanded pieces and flakes
Product density	Low-density expanded products

A number of experiments with formulas have been conducted on the MFM-KIST Extrusion Cooking System to the operating Characteristics, limitation and process requirements with the given procedures[12].

5. *Sensory Evaluation and Chemical Analysis*

The sensory evaluations were made by a group of 15 specialists in order to determine the odor, taste, texture and color of product by means of scoring difference test[13]. And also approximate compositions of each products were analyzed by AOAC Offical Methods[14].

RESULTS AND DISCUSSIONS

1. *Preliminary Formulation of Proposed Supplementary Foods*

Preliminary formulation of proposed supple-

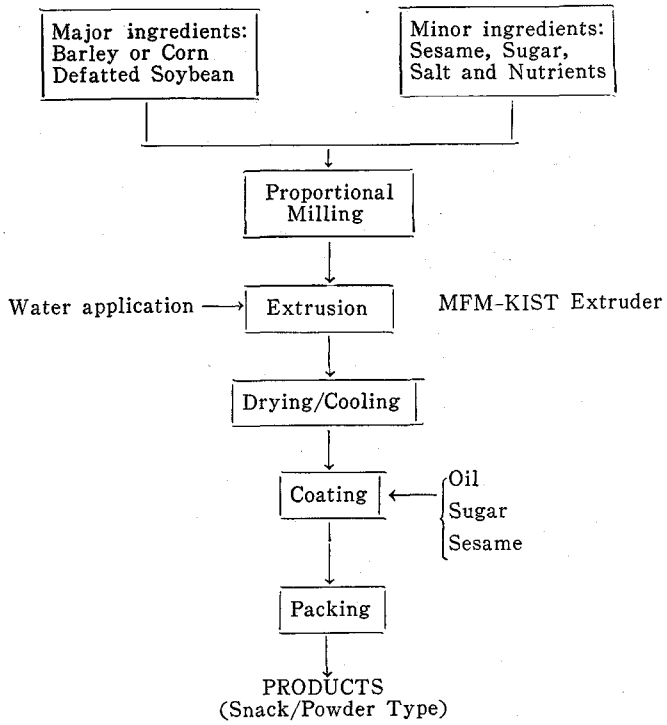

Fig. 1. MFM-KIST extrusion cooking system for the production of HNLC foods.

mentary foods for the Wonseong County Project was made on the basis of barley defatted soybean composition (BS) formulas, corn-defatted soybean composition (CS) formulas, barley-defatted soybean-fish (anchovy) composition (BSF) formulas, barley-defatted soybean-sesame composition (BSS formulas), corn-defatted soybean-sesame composition(CSS formulas) as shown in Table 2. The barley has been a staple food in the Korean diet for a long time and is produced as the second largest crops in Korea. Barley and corn were considered as a source of energy in BS, BSS, CS and CSS formulas. The soybean is the only crop in Korea which can economically raise protein content and improve protein quality of barley of corn after mixing. Addition of sesame, an acceptable food ingredients to the Korean, as a source of methionine and tryptophan would correct to some extent the efficiency of amino acids. The level of protein content in the formulas ranged from 17 to 21 per cent and the product is expected to provide about 329—391 Kcal per 100g of products.

For the moment, studies are actively being carried out for the development of HNLC foods especially for the developing countries in the form and nature characteristics to the indigenous circumstances of individual countries. For instance, in Latin America the Brady Extruder is being tested in food development using such raw materials as bean powder, linseeds, corn, millet and cassava. Other countries engaged in similar efforts are: Costa Rica, Bolivia Mexico and Chile[15]. And also there was a similar research works on the development

Table 2. Material Composition of Various Proposed Formulas (%)

Materials	BS	CS	BSS						CSS		
	(1)	(1)	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)
Barley Flour	70		56	63	63	65	68	70			
Corn Flour		70							56	63	65
Soybean Flour				27						27	
Defatted Soy Flour	28	28	28		27	25	22	20	28		25
Anchhovy Flour											
Sesame Seed			2	2	2	2	2	2	2	2	2
Soy Oil			6		2	2	2	2	6		2
Corn Oil											
Sugar			6	6	4	4	4	4	6	6	4
Others*	2	2	2	2	2	2	2	2	2	2	2
Protein(%)	21	20	20	17	20	18	18	17	19	17	18
Calorie(kcal/100g)	329	334	369	357	344	391	345	346	373	362	378

*Others include vitamins, minerals, salt and other additives.

of HNLC foods without any application of extrusion cooking system in Korea[16].

The finding of nutrition survey conducted in Wonseong County was indicated that protein and calorie consumption falls considerably behind the recommended level for Korean. Besides, calcium and vitamin (A and B_2) deficiencies are prevalent in the group of children[6]. Accordingly, special consideration of enrichment with vitamins (A and B_2) and minerals(calcium and iron) was also given to the formulas.

2. *Trial Production of Proposed Formulas with MFM-KIST Extruder*

A series of test operation for the proposed formulas have been conducted with the MFM-KIST extruder. As for the batch formula, satisfactory results could be obtained from formula CSS-1, CSS-3 and BSS-4 in terms of machine performance and product quality. Trials for the test production of formulas are summerized in Table 3. And also the operational conditions and results of test runs for the most acceptable formulas are summerized in Table 4. All formulas evaluated have been extruded without any serious mechanical problems if it has a moisture content of around 13 per cent as a minimum. Extrusion of raw material mixtures normally requires 155—165°C barrel temperature for acceptable cooking and expansion. CSS formulas had a more expanded(lower bulk density) products than BSS formulas. The extruded products could be used as a snack food or as a porridge base after milling. MFM-KIST Extrusion Cooking System was considered as one of typical process for HNLC foods production.

3. *Characteristics of Proposed Products*

Table 5 shows the results of sensory evalutions by scoring differences for flavor, taste, texture and color of BS-1, BSS-4, CSS-1 and CSS-3 formulas. Generally, the CSS formulas showed better scores than the BS or BSS for-

Table 3. Trials for test production of proposed formulas with MFM-KIST extruder

Formula*	Machine Performance	Product Quality
BS -1	Smooth	Slightly expaded/Good flavor
BSS-1	Fluctuating load	Small flakes/beany flavor
BSS-2	Not Smooth	Well expanded/Good flavor
BSS-3	Not Smooth	Small flakes/beany
BSS-4	Smooth	Well expanded/Good flavor
CSS-1	Smooth	Well expanded/roasted flavor
CSS-2	Fluctuating load	Small flakes/beany
CSS-3	Smooth	Well expanded/roasted flavor

*See: Material composition in Table 2

Table 4. Summary of operational conditions and test runs of selected formulas

Test Parameter	BSS-4*	CSS-3*
Average feed Sate (Kg/H)	84	90
Average water feeding (G/H)*p*	1.9	1.7
Main screw (RPM)	430	430
(Amps)	46.4	45.0
Feed screw (RPM)	78	78
(Amps)	4.0	4.1
Temperature cooked (°C)	158	162
Bulk density (g/cm^3)	0.24	0.15

* See: material composition in Table 2

mulas in flavor, taste and texture. However, there were no significant differences between CSS formulas. Also, BS-1 was not significantly different from BSS-4. All products had similar taste and aroma, and cooked soybean taste was found as aftertaste. It was noted that higher acceptability was with corn-based products rather than with barley-based products.

Trial products of BSS-4 and CSS-3 formulas have further been sub-classified into four different kinds of products, such as bar shape (0.6cm dia., 2.5cm long), cocoon shape (0.6 cm dia., 1.5cm long), granular shape and powder form. Based on these varieties, ASI Marketing Research Inc. Korea conducted a pilot product test (survey) against a total of 100 women and their preschool children of consumer level at Wonseong County[17]. In regard to the characteristics of products, the results of pilot product test could be summarized as followings: 1) A great number of preschool children (72%) preferred CSS-3 and 28% preferred BSS-4. 2) The reasons for preferring CSS-3 were "good taste (64%)" "smoother texture (17%)", "better aftertaste (11%)", "sweeter taste (11%)", compared with BSS-4. 3) And the reasons for not preferring BSS-4 were "beany taste (35%)", "not salty enough (24%)", muddy taste (14%)", compared with CSS-3, 4) 73% of the mothers preferred "large" among four kinds of product from (large,

Table 5. Results of sensory evaluation of product*

	BS-1	BSS-4	CSS-1	CSS-3
Flavor	3.6	3.7	2.9	3.0
Taste	3.8	3.3	2.4	2.6
Texture	3.6	3.3	2.4	2.4
Color	4.3	3.9	2.8	2.1

* Scoring was based on a 6-point system (excellent: 1 point; very bad: 6 point, and the score of products bound with a line means there is no significant difference between them at the 1% level.

Table 6. Material composition of selected formulas for HNLC supplementary foods for the Children in Korea

Materials	CSS-3 (%)	CSS-4		BSS-4 (%)
		Sweety (%)	Salty (%)	
Corn flour	65.0	68.0	68.0	—
Barley flour	—	—	—	65.0
Defatted soybean flour	25.0	20.0	20.0	25.0
Sesame flour	2.0	2.0	2.0	2.0
Soybean oil	2.0	—	—	2.0
Corn Oil	—	3.0	4.0	—
Sugar	4.0	5.5	4.0	4.0
Salt	1.0	0.5	1.0	1.0
Others*	1.0	1.0	1.0	1.0

* Others include vitamins, minerals and other additives.

medium, grain, powder) and the reasons for preferring large form were "not crumby (96.3%)", "looks tasty (9.6%)"[17]. Adjustment and modification trials were also conducted ba sed on the results of pilot product test. As a results, an additional formula of CSS-4 (see Table 6) was developed for better acceptability, the characteristics of which were for less defatted soybean flour content and for comparatively more corn flour and oil as compared with CSS-3 formula. And also in CSS-4 formula the oil used was not of soybean but of corn.

The basic formula for HNLC supplementary foods is shown in Table 5. However, note that other flavor ingredients, such as peanut, vanilla, chocolate or cheese, may be applicable in order to give variety. All these proposed formulas were still found in the acceptable range of costs[1]. The nutritional qualities and storage stabilities of proposed products will be discussed in the following research papers in Part Ⅱ and Part Ⅲ in the series of this study.

SUMMARY

Formulation and production performance of proposed high nutriton-low cost (HNLC) supplementary foods for children in Korea were studied for Wonseong County Comprehensive

Nutrition Program. The basic formulas recommendable from the experimental results on the nutritional value, organoleptical qualities and mechanical performance using MFM-KIST extrusion cooking system were considered as CSS-3, CSS-4 and BSS-4. Initial priority of application soybean was with CSS-4(68% corn flour, defatted soybean flour 20%, sesame 2%, corn oil 4%, sugar 4%, salt 1%, vitamins, mineral and other additives 1%). All these formulas as en riched snack type-HNLC supplementary foods were found in the acceptable range of mechanical, organoleptical and economical point of view.

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◍ 1980년도(제 4 회) 학회상 수상논문 및 수상자

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장려상 : —

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◍ 식량 절약과 영양적으로 균형된 식단개발연구 사업을 농수산부 장관 위촉으로 1980년 11월 25일에서 1981년 1월 25일에 걸쳐 이기열 본학회 회장을 연구책임자로 하여 다음의 교수들과 영양학회 이사들이 참여한 가운데 진행되었다.

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⑧ 삼육 농업 전문대학
⑨ 숭전대학교
⑩ 신흥보건 전문대학

◇ 1981년 제12회 국제영양학회 안내

시 일 : 1981년 8월 16일~8월 21일
장 소 : 미국 California 주 San Diego
Congress Theme:
Nutrition: Basic to human health and international development

Scientific Program

Symposia

1. Trace elements in human nutrition
2. Nutrition and chronic disease
3. The fat-soluble vitamins
4. Nutritional status and susceptibility to disease
5. Drug-nutrient interactions
6. Nutritional intervention programs
7. Nutritional anemias
8. The function of the gastrointestinal tract in health and disease
9. The nutrition component of national policy and planning
10. Nutrition, brain function, and behavior
11. Marginal malnutrition: its assessment and functional consequences
12. Protein-energy requirements and interactions
13. Maternal, fetal, and neonatal nutrition
14. Nutritional care of hospitalized patients

Mini-symposia(combining reviews with free communications)

1. Energy regulation in animals and man
2. Nutritional anthropology

3. Nutritional epidemiology
4. The water-soluble vitam ins
5. Protein calorie malnutrition
6. Non-nutrient dietary components including fiber
7. Changing food patterns
8. Bioenergetics and nutrition of fish.
9. Nutrition and aging
10. Interactions between food components and their nutrition significance
11. Energy cost of food and nutrition systems
12. Role of ruminants in producing nutrients for man
13. Novel sources of protein in animal and human nutrition

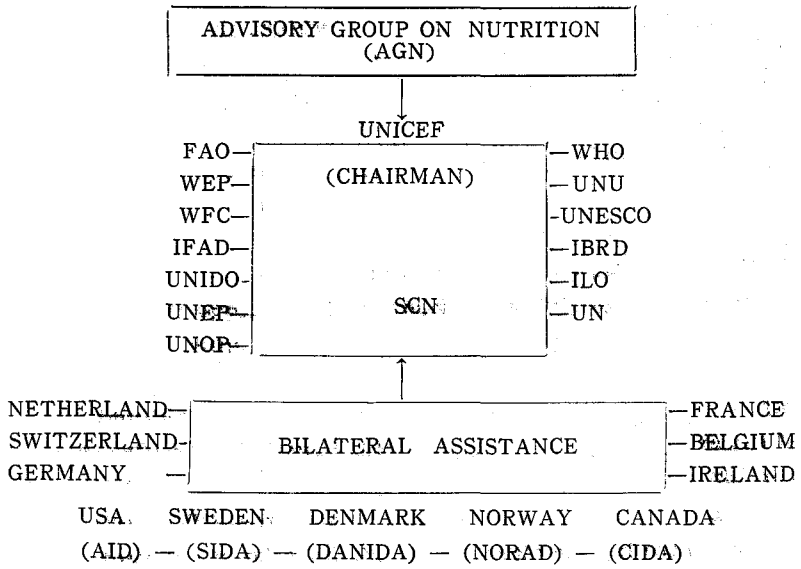
Free Communicati ons(presented orally or in poster sessions)

Oral presentations will be scheduled for ten-minute periods followed by five minutes for discussion. Free communications will be accepted in the following subject areas.

1. Trace elements
2. Nutrition and cancer
3. Nutrition and aging
4. Fat-soluble vitamins
5. Nutritional status and the immune response
6. Drug-nutrient and nutrient-nutrient interactions
7. Long-term consequences of nutrition in early life
8. Obesity
9. Nutritional anemias
10. Neonatal nutrition
11. The nutrition component of national development planning
12. The effect of non-nutrient dietary components
13. Nutrition brain development and behavior
14. Carbohydrates(including fiber)
15. Nutrition and cardiovascular diseases
16. Changing food patterns and their health implications
17. Quantitative assessment of nutritional status in population studies
18. Biochemistry of lipids in health and disease
19. The functional consequences of subclinical malnutrition
20. Nutrition behavior and social deviancy
21. Results of nutrition intervention programs
22. Water-soluble vitamins
23. Historical perspective—hyperalimentation
24. Delivery of nutritional care to hospitalized patients—medical pediatric and surgical
25. Nutrition and diseases of the skeletal system
26. Nutritional pharmacology
27. Nutritional anthropology
28. Protein-calorie malnutrition
29. Proteins
30. Nutrition and pregnancy
31. Nutrition education
32. Clinical nutrition
33. Control of nutrient metabolism
34. Dietary thermogenesis
35. Major mineral nutrition
36. Etiology of malutrition
37. Nutrition and parasitism in humans and animals
38. Energy considerations in food and nutrition programs
39. Novel sources of protein
40. Animal nutrition
41. Role of animals in producing nutrients for man
42. Fish nutrition
43. Interations between chemicals and nutrients in foods and their significance

Abstract forms are included for individuals who wish to present a free communication. The deadline for receipt of abstracts is *Fedruary 28 1981*. The Congress registration form and fee must accompany the abstract.

◉ 세계 영양문제 자문기관 명단



UNICEF: United Nations International Childrens Emergency Fund.
SCN: The Subcommittee on Nutrition
FAO: The Food and Agriculture Organization
WHO: The World Health Organization
WFP: The World Food Programme
WFC: The World Food Council
UNESCO: The United Nations Educational Scientific and Cultural Organization
UNIDO: The United Nations Industrial Development Organization
ILO: The International Labor Organization
IBRD: The International Bank for Reconstruction and Development
UNDP: The United Nations Development Programme
IFAD: The International Fund for Agricultural Development
UNU: The United Nations University
UN: The United Nations.

● 14권(1981) 6월호의 원고마감일은 **1981년 5월 1일**까지 서울대학교 식품영양학과 최혜미교수 앞으로 보내 주시기 바람.

주의사항

1. 참고문헌과 Table은 반드시 Type 할것.
2. Table과 Fig.는 한장에 하나씩만 할것.
3. Fig.는 원본을 보낼것(저자가 원하면 다시 돌려드림).
4. Table과 Fig.는 원고 맨마지막에 묶을것.
5. 참고문헌은 13권 2,3호를 참고할 것.
6. Journal의 약자는 영양학회자 13권 4호에 실려있음.

Journal

Wallentin L. & Sköldstam, L.: Lipoproteins and Cholesterol esterification rate in plasma during a 10-day modified fast in man. Am. J. Clin. Nutr. 33 : 1925—1931, 1980.

Book

Eastwood, M.A., & Mitchell, W.D.: Physical properties of fiber. In: Fiber and Human Nutrition, ed. Spiller, G.A., & Amen, R.J. pp. 109—130, Plenum Press, New York, 1976.

◉ 논문에 흔히 사용하는 약자 ◉

Commonly used Approved Abbreviations

Standard Units of Measurement

Term	Abbreviation or Symbol
ampere	A
angström	Å
barn	b
candela	cd
coulomb	C
counts per minute	cpm
counts per second	cps
curie	Ci
degree Celsius	°C
disintegration per minute	dpm
disintegration per second	dps
electron Volt	eV
equivalent	Eq
farad	F
gauss	G
gram	g
henry	H
hertz	Hz
hour	h
international unit	IU
joule	J
kelvin	K
kilogram	kg
liter, litre	l or L
meter, metre	m
minute	min
molar	*M*
mole	mol
newton	N
normal(concentration)	N
ohm	Ω
osmol	osmol
pascal	Pa
revolutions per minute	rpm
second	s
square centimeter	cm
volt	V
watt	w
week	wk
year	yr

Combining Prefixes

tera-	(10^{12}) T
giga-	(10^{9}) G
mega-	(10^{6}) M
kilo-	(10^{3}) k
hecto-	(10^{2}) h
deca-	(10^{1}) da
deci-	(10^{-1}) d
centi-	(10^{-2}) c
milli-	(10^{-3}) m
micro-	(10^{-6}) μ
nano-	(10^{-9}) n
pico-	(10^{-12}) p
femto-	(10^{-15}) f
atto-	(10^{-18}) a

Statistical Terms

correlation coefficient	r
degress of freedom	df
mean	x
not significant	NS
number of observations	n
probability	p
standard deviation	SD
standard error of the mean	SEM
Student's t test	*t* test
variance ratio	F

Others

adenosinediphosphatase	ADPase
adenosine 5′-diphosphate(adenosine diphosphate)	ADP
adenosine 5-monophosphate(adenosine monophosphate, adenylic acid)	AMP
adenosine triphosphatase	ATPase
adenosine 5′-triphosphate(adenosine triphosphate)	ATP
adrenocorticotropic hormone(adrenocorticotropin)	ACTH
bacille Calmette-Guérin	BCG
basal metabolic rate	BMR
body temperature, pressure, and saturated	BTPS

central nervous system	CNS
coenzyme A	coA
deoxyribonucleic acid(deoxyribonucleate)	DNA
dihydroxyphenethylamine	dopamine
electrocardiogram	ECG
Electroencephalogram	EEG
enteric cytopathogenic human orphan(virus)	ECHO
ethyl	Et
ethylenediaminetetracetate	EDTA
gas-liquid chromatography	GLC
guanosine 5′-monophosphate(guanosine monophosphate, guanylic acid)	GMP
hemoglobin	Hb
logarithm(to base 10 ; common logarithm)	log
logarithm, natural	ln
methyl	Me
Michaelis constant	*Km*
negative logarithm of hydrogen ion activity	pH
partial pressure of CO_2	Pco_2
partial pressure of O_2	PO_2
per	/
percent	%
radiation(ionzing, absorbed dose)	rad
respiratory quotient	RQ
specific gravity	sp gr
standard atmosphere	atm
standard temperature and pressure	STP
ultraviolet	uv
volume	vol
volume ratio(volume per volume)	vol/vol
weight	wt
weight per volume	wt/vol
weight ratio(weight per weight)	wt/wt

Abbrevitions of Names of Frequently Cited Journals

Acta Medica Scandinavica	Acta Med Scand
American Family Physician	Am Fam Physician
American Heart Journal	Am Heart J
American Journal of Cardiology	Am J Cardiol
American Journal of Clinical Nutrition	Am J Clin Nutr
American Journal of Clinical Pathology	Am J Clin Pathol
American Journal of Digestive Diseases	Am J Dig Dis
American Journal of Diseases of Children	Am J Dis Child
American Journal of Human Genetics	Am J Hum Genet
American Journal of the Medical Sciences	Am J Med Sci
American Journal of Medicine	Am J Med
American Journal of Obstertrics and Gynecology	Am J Obstet Gynecol
American Journal of Ophthalmology	Am J Ophthalmol
American Journal of Pathology	Am J Pathol
American Journal of Physical Medicine	Am J Phys Med
American Journal of Physiology	Am J Physiol
American Journal of Psychiatry	Am J Psychaitry
American Journal of Public Health	Am J Public Health
American Journal of Roentgenology	AJR
American Journal of Surgery	Am J Surg
American Journal of Tropical Medicine and Hygiene	Am J Trop Med Hyg
American Review of Respiratory Disease	Am Rev Repir Dis
Anaesthesia	Anaesthesia
Anesthesiology	Anesthesiology
Annals of Allergy	Ann Allergy
Annals of Internal Medicine	Ann Intern Med
Annals of Otology, Rhinology and Laryngology	Ann Otol Rhinol

	Laryngol
Annals of Surgery	Ann Surg
Annals of Thoracic Surgery	Ann Thorac Surg
Archives of Dermatology	Arch Dermatol
Archives of Environmental Health	Arch Environ Health
Archives of General Psychiatry	Arch Gen Psychchiatry
Archives of Internal Medicine	Arch Intern Med
Archives of Neurology	Arch Neurol
Archives of Ophthalmology	Arch Ophthalmol
Archives of Otolaryngology	Arch Otolaryngol
Achives of Pathology and Laboratory Medicine	Arch Pathol Lab Med
Archives of Physical Medicine and Rehabilitation	Arch Phys Med Rehabil
Archives of Surgery	Arch Surg
Arthritis and Rheumatism	Arthritis Rheum
Blood; Journal of Hematology	Blood
Brain; Journal of Neurology	Brain
British Heart Journal	Br Heart J
British Journal of Obstertrics and Gynaecology	Br J Obstet Gynaecol
British Journal of Radiology	Br J Radiol
British Journal of Surgery	Br J Surg
British Medical Journal	Br Med J
Canadian Journal of Public Health	Can J Public Health
Canadian Medical Association Journal	Can Med Assoc J
Cancer	Cancer
Chest	Chest
Circulation; Journal of the American Heart Association	Circulation
Circulation Research	Circ Res
Clinical Pediatrics	Clin Pediatr(Phila)
Clinical Pharmacology and Therapeutics	Clin Pharmacol Ther
Clinical Science and Molecular Medicine	Clin Sci Mol Med
Clinical Toxicology	Clin Toxicol
Diabetes	Diabetes
DM; Disease-a-Month	DM
Endocrinology	Endocrinology
Gastroenterterology	Gastroenterology
Geriatrics	Geriatrics
Gut	Gut
Human Pathology	Hum Pathol
Investigative Radiology	Invest Radiol
JAMA. Journal of the American Medical Association	JAMA
Journal of Allergy and Clinical Immunology	Allergy Clin Immunol
Journal of Applied Physiology	J Appl Physiol
Journal of Biological Chemistry	J Biol Chem
Journal of Bone and Joint Surgery American Volume	J Bone Joint Surg [Am]
Journal of Bone and Joint Surgery British Volume	J Bone Joint Surg [Br]
Journal of Clinical Endocrinology and Metabolism	J Clin Endocrinol Metab
Journal of Clinical Investigation	J Clin Invest
Journal of Clinical Pathology	J Clin Pathol
Journal of Experimental Medicine	J Exp Med
Journal of Gerontology	J Gerontol
Journal of Immunology	J Immunol
Journal of Infectious Diseases	J Infect Dis
Journal of Investigative Dermatology	J Invest Dermatol
Journal of Laboratory and Clinical Medicine	J Lab Clin Med
Journal of Laryngology and Otology	J Laryngol Otol
Journal of Medical Education	J Med Educ
Journal of Nervous and Mental Disease	J Nerv Ment Dis
Journal of Neurosurgery	J Neurosurg
Journal of Pathology	J Pathol
Journal of Pediatrics	J Pediatr
Journal of Physiology	J Physiol

□ 학 회 소 식 □

Journal of Thoracic and Cardiovascular Surgery	J Thorac Cardiovasc Sugr
Journal of Trauma	J Trauma
Journal of Urology	J Urol
Lancet	Lancet
Medical Clinics of North America	Med Clin North Am
Medical Letter on Drugs and Therapeutics	Med Lett Drugs Ther
Medicine(Baltimore)	Medicine(Baltimore)
New England Journal of Medicine	N Engl J Med
Obstetrics and Gynecology	Obstet Gynecol
Pediatric Clinics of North America	Pediatr Clin North Am
Pediatrics	Pediatrics
Physiological Reviews	Physiol Rev
Plastic and Reconstructive Surgery	Plast Reconstr Surg
Postgraduate Medicine	Postgrad Med
Progress in Cardiovascular Diseases	Progr Cardiovasc Dis
Public Health Reports	Public Heltha Rep
Radiology	Radiology
Rheumatology and Rehabilitation	Rheumatol Rehabil
Seminars in Roentgenology	Semin Roentgenol
Surgery	Surgery
Surgery, Gynecology and Obstetrics	Surg Gynecol Obstet

그동안 학술이사로 수고하셨던 박 현서 교수(경희대, 식품영양학과)께서 연구차 Michigan 대학교(Ann Arbor)에 가시게 되므로 지난 12월 27일에 있었던 상임이사회에서 최 혜미 교수(서울대, 식품영양학과)께서 잔임기간을 맡아주시기로 정하였읍니다.

최 혜미 교수의 연락처는 다음과 같습니다.

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최 혜미 교수 (전화 : 877—0101, 교환 : 2812)

◇ **합본된 학회지 구입안내** ◇

한국영양학회지(1976년~1979년)가 합본되어 나왔으니 원하시는 분은 영양학회 사무실로 신청 구입할 수 있읍니다.

제 9권~12권(1976~1979년) : 24,000원

심사료제출 : 금번 12권 1호(1980년 3월호)부터 원고제출시 심사료 5,000원을 제출키로 하였음.
논문게재재초과료 : 4면이상은 초과료 실비 부담. 그림도 본인이 부담함.