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빅데이터 분석을 활용한 콜라겐 섭취가 피부에 미치는 영향에 관한 메타분석

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A Meta-Analysis of Influencing Collagen Intake on Skin Utilizing Big Data

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요 약

빅데이터 분석은 데이터 저장소에 저장된 대용량 데이터 속에서 의미 있는 새로운 상관관계, 패턴, 추세를 발견하여 새로운 가치를 창출하는 과정이다. 메타분석은 유의성 검정이라 하기보다는 예측변수가 종속변수에 미치는 영향의 크기가 중요한 이슈이다. 따라서 본 연구는 2000년-2016년 사이 콜라겐 섭취가 피부에 미치는 영향에 관한 관련 주제로 출판된 연구 6개 논문 236개 샘플을 대상으로 하였다. 연구결과를 요약하면 다음과 같다. 첫째, 피지 사전사후 경로에서 가장 큰 효과크기 (r = .412)를 가지는 것으로 나타났다. 따라서 콜라겐 섭취 중재는 약 17 (%) 설명력을 가지는 것으로 나타났다. 다음으로, 수분 사전사후 경로에서는 효과크기 (r = .318)를 가지는 것으로 나타났다. 분석결과를 바탕으로 연구의 한계와 시사점을 제시하였다.

ABSTRACT

Big data analysis, in the large amount of data stored as the data warehouse which it refers the process of discovering meaningful new correlations, patterns, trends and creating new values. The important issue of a meta-analysis is not the significance test, the effect size of the predictor variable on the criterion variable. We reviewed a total of 236 samples among 6 studies published on the topic related Collagen intake on skin between 2000 and 2016 in Korea. The results of the study are summarized as follows. First, we concluded that the path between before and after of Sebum (*SB*) had the largest effect size of (r = .416) Therefore, the effect of the Collagen intake intervention showed an explanatory power of 17 (%) about. Next, the path between before and after of Moisture (*MS*) had the higher the effect size of (r = .318). Thus, we present the theoretical and practical implications of these results.

키워드 : 빅데이터, 메타분석, 콜라겐 섭취, 피부, 이너뷰티

Key word : Big data, Meta-analysis, Collagen intake, Skin, Inner beauty

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Ⅰ. INTRODUCTION

Social development and economically growth brought about medical development and economic rich, It has changed the goal of higher life to improve the quality of life and to design a young and beautiful life. Healthy life, This means the life expectancy of a human being minus an unhealthy period due to illness or disaster [1]. According to the Statistics Korea in 2013, the average life of Koreans can survive 78.5 years for men and 85.0 years for women [2]. Inner beauty means inner beauty, it means eating or applying to the skin in the form of cosmetics, or improving the health of the skin through eating habits and lifestyle. The improvement of the income of the people of Korea has brought about the concern about health, and the interest in health functional foods has been greatly increased. The main Ingredients of Inner beauty is vitamins, collagen, and hyaluronic acid. The vitamin is an essential nutrient in the metabolism of our body. Vitamin C help skin whitening, and collagen helps with the elasticity of the skin in relation to the anti-aging. Hyaluronic acid is known to be a major Ingredients that helps maintain moisturizing [3].

According to 3 of the law on health functional foods in Korea, which it refers to foods manufactured and processed using raw materials and ingredients having useful functions in the human body. At this time, functionality means to obtain beneficial effects on human body structure and function, such as controlling nutrients or physiological functions [4]. Health functional foods are intermediate forms between medicines and foods, classification by function is largely divided into regulation of biological rhythm, biological defense, disease prevention, disease recovery, and aging suppression. Inner beauty, it is called eating cosmetics belongs to the boundaries of cosmetics and foods. By eating supplements as a food for skin care in the human body, in order to eat good supplements for your skin, it is said to eat cosmetics. In some cases, inner beauty is also called beauty food. Inner beauty products are categorized as health functional foods according to the Korea food drug administration. In the range of health food functional law is able to production, sales, and distribution [3].

Ⅱ. PREVIOUS RESEARCH

Until recently, there are many research papers on health functional foods and health supplements in Korea. There were not so many papers related to inner beauty, collagen, and eating cosmetics. In previous research related inner beauty, the study on “Marketing Strategies and Consumer Recognition of Inner Beauty Cosmetics” [5], listed 60.3 (%) of the respondents answered that they knew about inner beauty. In previous research related collagen, the study on “The Effect Analysis on Middle-aged Women's Facial Wrinkles Improvement of Shaking Neck Exercise and Collagen Diet” [6], reported which collagen diet has positive effects on melanin index, erythema index, viscoelasticity and wrinkle of facial skin of middle aged women.

Next, the study on “Influence of collagen intake upon facial-skin wrinkles” [7], Suggested that the ingestion of collagen has a tendency to alleviate the skin wrinkles on the face. Next, the study on “The Effect of the Complex Dietary Treatment of Collagen and Vinegar on the Improvement of Women's Neck Skin” [8], listed that Increased collagen in the blood increases collagen synthesis in the dermis of the neck skin and maintains elasticity to help skin recovery.

Finally, the study on “The Effect of Collagen and Enzyme Food Intake on 40’s~60’s Women’s Facial Skin” [9], to evaluate how collagen and enzyme food intake affect 40’s~60’s women’s facial skin aging, found that enzyme foods are more important than cosmetics for the beauty of skin of middle-aged women. Thus, To define the physiological correlation between collagen and enzyme food and skin aging, the further research is required.

Ⅲ. RESEARCH METHODOLOGY

To determine the effect of Collagen intake on human skin, it is only targeted factors as Wrinkles, Melanin index, Erythema index, Viscoelastic, Moisture and Sebum. The conceptual model is shown in Figure 1. This study will report meaningful effect of Collagen intake intervention for criterion variables that affect pre and post Collagen intake studies, on the basis of the results of a meta-analysis. The papers included in this study meta-analysis were identified using the keywords “Collagen”, “Collagen intake”, specifying on RISS, DBpia, eArticle, and Kyobo Scholar in database articles of social science. We reviewed a total of 6 studies related Collagen intake within journals and theses published in Korea between 2000 and 2016, where a cause and effect relationship is established between variables that are specified in the conceptual model of this study. Based on the methodology of meta-analysis, was utilized the CMA (comprehensive meta analysis) program developed by Biostat was utilized.

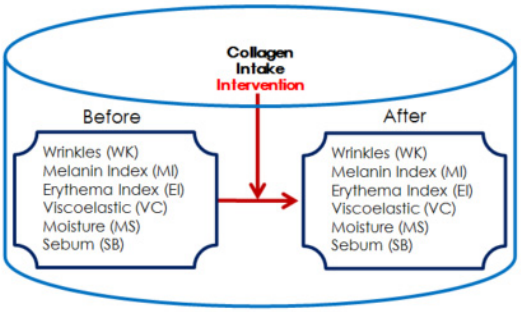

Fig. 1 The conceptual model

The following Table 1 lists authors, terms, goal and samples used as the raw data for the meta-analysis. By using collected raw data, the calculated number of standard deviations and samples were coded that verified studies influencing before and after in factors of the conceptual model. Therefore, the mean, standard deviation, and the number of samples calculated the effect size using Equation 1.

Table. 1 Raw data of studies used in meta-analysis

N	Authors	Terms	Goal		*n*
1	Kim & Kang (2012)	12W	Neck Wrinkles	CFN	8
2		12W		LN	8
3		12W		RN	8
4		12W		CBN	8
5		12W	Facial Wrinkles	FH	8
6		12W		LC	8
7		12W		RC	8
8		12W		CH	8
9	Baek (2011)	12W	Skin	FS	14
10	Shin & Kang (2012)	12W	Skin	HS	11
11	Baek et al. (2012)	12W	Skin	NS	15
12	Kim & Kang (2016)	12W	Skin	FS	12
13	Kim (2016)	12W	Skin	FH	12
14		12W	Skin	LE	12
15		12W	Skin	RE	12
16		12W	Skin	LC	12
17		12W	Skin	RC	12
18		12W	Skin	CH	12
19		12W	Skin	FN	12
20		12W	Skin	LN	12
21		12W	Skin	RN	12
22		12W	Skin	BN	12
Sum of samples					236

BN: Back neck, CH: Chin, CBN: Center of back neck, CFN: Center of front neck, FH: Forehead, FN: Front neck, FS: Facial skin, HS: Hands skin, LC: Left cheek, LE: Left eye, LN: Left neck, NS: Neck skin, RC: Right cheek, RE: Right eye, RN: Right neck

$$ES(d) = \frac{\overline{X_e} - \overline{X_c}}{S_{pooled}} \quad (1)$$

$\overline{X_e}$: Mean of Post Group

$\overline{X_c}$: Mean of Pre Group

S_{pooled} : Combined Standard Deviation

$$S_{pooled} = \sqrt{\frac{(n_e-1)S_e^2 + (n_c-1)S_c^2}{n_e + n_c - 2}}$$

n_e : Sample size of Post Group

n_c : Sample size of Pre Group

s_e : Standard Deviation of Post Group

s_c : Standard Deviation of Pre Group

To understand whether the value extracted from the same population was calculated using the equation 2 proposed by Hedges and Stock [10].

$$Q = \sum(Wd^2) - \frac{\sum(Wd)^2}{\sum W} \quad (2)$$

Q : Coefficient of Homogeneity
W: Inverse Weighted Values
d : Size of Effect

$$N_{fs} = \frac{N(d-d_c)}{d_c} \quad (3)$$

N_{fs} : Number Fail-safe
N : Number of Papers
d : Size of Effect
d_c : Small Size of Effect

In the stability test, the publication bias occurs because the data sampled for use only paper published in order to a meta-analysis. Orwin [11] was devised to overcome this problem that resolved through the test of stability. The test of stability is shown in Equation 3. In Cohen [12], the author proposed a method to interpret the effect size, where $ESr \leq .10$ is defined as a small effect size; $ESr = .25$, a medium effect size; and $ESr \geq .40$, a large effect size.

Ⅳ. META-ANALYSIS

The homogeneity test in the meta-analysis was performed on these research subjects to find that the effect sizes of multiple independent studies are values extracted from the same population. The null hypothesis for the statistical homogeneity test is that there is no difference in the estimated effect sizes of the individual study results. Therefore, if the null hypothesis is proved, we can perform a meta-analysis to obtain estimates of the overall effect size by incorporating effect size estimates. The interpretation of the homogeneity test is based on a chi-square distribution of the test statistic, *Q* value, since the *Q* value is equal to the *chi-square* distribution [10, 13]. The results of the homogeneity test conducted in this study are presented in Table 2.

Table. 2 Results of homogeneity test

Paths	*df*	Critical region	*Q*	*P*
(*WK*) Before → After	9	16.92	10.2	.000
(*MI*) Before → After	13	22.36	15.9	.000
(*EI*) Before → After	17	27.59	17.2	.000
(*VC*) Before → After	7	14.07	0.9	.000
(*MS*) Before → After	10	18.31	11.8	.000
(*SB*) Before → After	10	18.31	10.6	.000

Q: Q statistics, df: degree of freedom

Q values from the paths between (*WK*) before → after, (*MI*) before → after, (*EI*) before → after, (*VC*) before → after, (*MS*) before → after, and (*SB*) before → after are 10.2, 93.5, 90.2, 0.9, 11.8, and 10.6, respectively. When the degrees of freedom (*df*) are 9, 13, 17, 7, 10, and 10 the limit values of the *chi-squared* distribution become 16.92, 22.36, 27.59, 14.07, 18.31, and 18.31, respectively where $p = .05$. Since the *Q* values as Melanin index (*MI*) and Erythema index (*EI*) are larger than the limit values, the null hypothesis of homogeneity is rejected. Thus, we can establish an estimation that these are extracted from a heterogeneous population, rather than from the same population. This explains that the distribution of effect sizes in all paths exceeds the standard error. In this heterogeneous case, we calculate the average effect size by using calibrated inverse variance weighting values with the random-ffects model, not the fixed-effect model [14].

And, the *Q* values as Wrinkles (*WK*), Viscoelastic (*VC*), Moisture (*MS*), Sebum (*SB*) are smaller than the limit values, the null hypothesis of homogeneity is accepted. In this homogeneous case, we calculate the average effect size by using the fixed-effect model.

The most problematic issue of integrating studies for the meta-analysis is the one related to study bias where unpublished papers were integrated with published papers into this study sample. Unpublished papers cover cases in which researchers may commit errors with insignificant research results, miss the right time of publication, and/or not meet the screening requirements

of the reviewers. These problems are called publication bias, or the file drawer problem, and are explained to commit Type I mistakes [15]. This implies that papers published in journals have a high likelihood of positive results as compared to unpublished papers.

Table. 3 Results of meta-analysis (effect size)

Paths	F/R	*d, r*	*Nfs*	*dc*
(*WK*) Before → After	Fixed	-.294	4.70	.2
(*MI*) Before → After	Random	-.138	-4.34	
(*EI*) Before → After	Random	-.240	3.60	
(*VC*) Before → After	Fixed	.196	-0.16	
(*MS*) Before → After	Fixed	.318	6.49	
(*SB*) Before → After	Fixed	.416	11.88	

N: number of studies, *d, r*: effect size, *Nfs*: number fail-safe, *dc*: small effect size

In the meta-analysis, we review the validity of the research by checking the deflection possession through the stability factor, or the concept of fail-safe *N*. In particular, the stability factor or fail-safe *N* is the number of necessary studies to flip the significant findings into insignificant findings [11]. If the stability factor is 10, for example, the findings can be changed to a low effect size when 10 papers of effect size 0 are added. When fail-safe *N* is greater or the number of add papers is large, we can conclude that the consolidated treatment effect through a meta-analysis is true unless there is a sufficient number of unfounded or unpublished papers. Based on the theory above, the results calculated using the medium effect size suggested by Cohen [12] a represented in Table 3.

Ⅴ. RESULTS and CONCLUSIONS

This study reanalyzed the research studies with the purpose of classifying the results of the previous studies which analyzed causal relationships between before and after as Wrinkles (*WK*), Melanin index (*MI*), Erythema index (*EI*), Viscoelastic (*VC*), Moisture (*MS*), and Sebum (*SB*) in the designed the conceptual model. Based on information from these literature reviews, paths presented in the conceptual model in this study are converted to values of average effect size by using the random-effects model and the fixed-effect model, as the effect size (*r*) shown Table 3.

Theoretical and practical implications of this study are as follows. After considering the meta-analysis results in detail, first, we concluded that the path between before and after of Sebum (*SB*) had the largest effect size of (r = .416). Therefore, the effect of Collagen intake intervention showed an explanatory power of 17 (%) about. Unfortunately, It has been shown to have a negative effect on female skin. Next, the path between before and after of Moisture (*MS*) had the higher the effect size of (r = .318). Thus, the effect of Collagen intake intervention showed an explanatory power of 10 (%) about. The results of this study suggest that Collagen intake has a positive effect on female skin.

Next, the path between before and after of Wrinkles (*WK*) had the higher the effect size of (r = -.294). Thus, the effect of Collagen intake intervention reported an explanatory power of 9 (%) about. Obviously, Collagen intake has a positive effect on female skin. Next, the path between before and after of Erythema index (*EI*) had the higher the effect size of (r = -.240). Accordingly, the effect of Collagen intake intervention calculated an explanatory power of 6 (%) about. Finally, the path between pre and post of the Viscoelastic (*VC*), Melanin index (*MI*) had the lowest the effect size of (r = .196, and -.138), respectively. Consequently, the effect of soybean intervention listed an explanatory power of 4, 2 (%) about. In conclusion, the result of the study is significant in that we can estimate effect sizes on the basis of path constructs.

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