

FOLLOW THE LEADER



Heuristics in Nutrition
Communication

Follow the Leader: Heuristics in Nutrition Communication

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Preface

I cannot really tell you what it is that fascinates me about nutrition communication, but I always believed it had something to do with a sense of irony I hold dear. There are numerous sources for information about nutrition: documentaries, books, internet platforms and even support groups that all convey some message about what to eat, how to eat it and why to eat it. I can enjoy a dramatic documentary that tries to make you scared for McDonalds burgers, or a film that is just produced to make you vegan, although in different ways. Sometimes they are noteworthy – like ‘Super-Size Me’– but most of the time they are laughable. When the first shot of a documentary presents a crowded shopping street and the camera lens zooms in on people’s behinds that can be regarded as ‘too fat’ – that is the moment that a documentary becomes a comedy for me. Because some people just share a message because it fits their ideology, not because it is part of the truth. And some people will go great lengths to convince you of their cause, even if it means that they have to produce a one-sided message full of fallacies.

A while back I saw a news-item about a doctor who discovered something complicated that could make you younger. Please don’t ask me what, but it was remarkable. After this, two very hip individuals were given the chance to express their opinion. One mentally young mid-aged woman who loved to jump on shoes with air filled cushions for soles – she saw it as exercise – and one elderly man that took like fifteen pills per day to keep himself young and vibrant. It was this man that inspired me to choose the topic of this thesis. I was amazed about his commitment to spend as much time as possible on this planet, but at the same time, a curiosity arose about the reasons why and how he uses that much supplements. And thus, I looked into nutrition communication with respect to dietary supplement use.

Thanks to all involved: Laura for the supervision; all my participants for the interest they showed and how they also wanted to help me and to my family for all their support. Happy reading!

Abstract

Background: The problem statement in this study regards the prevalent confusion among consumers partly due to the diversity of nutrition information that is available for consumers. In a food environment that is facilitating dietary related chronic conditions, nutrition communication has become paramount to suffice the public in nutrition literacy. A proportion of the public reached to dietary supplements to support their health, however supplement use is not devoid of risks. An excess of use can result in adverse effects; it can be toxic, influence beforehand acquired healthy behaviors or can be unnecessary.

Objective: To identify the needs of dietary supplement users with respect to nutrition communication so that this communication can be tailored to dietary supplement users to communicate possible risks or the degree of necessity of dietary supplement use. This study explores the (possible) differences between dietary users and non-users with respect to their information search and evaluation strategies with respect to nutrition communication.

Theoretical framework: The heuristic-systematic model was employed to assess whether dietary supplement users were more focused on the argumentative qualities (systematic processing) in nutrition communication rather than the use of fast decision rules to evaluate nutrition communication (heuristic processing). In this study, these fast decisions rules could be related to the format, content or source of a message.

Method: A literature review and interviews were conducted to gather data regarding dietary supplement users' and non-users' characteristics, information searching methods and evaluation strategies. A think aloud protocol was used to analyze how users and non-users of supplements evaluated three articles regarding antioxidants. Additionally, they were asked about motivations regarding supplements and views and values regarding nutrition communication.

Results: In general, dietary supplement users were female and had healthy lifestyles in which proper nutrition, exercise, mediocre alcohol consumption and non-smoking stood central. Users were motivated due to chronic conditions and/or a high self-efficacy regarding nutrition. This resulted in a more systematic evaluation of nutrition communication than non-users. Users decided in a greater degree on the basis of content. Moreover, users used more unconventional channels for information acquirement than non-users.

Conclusion: These findings indicate that due to a higher involvement in nutrition, users tend to be more analytical towards the arguments instead of using fast decision rules regarding content, format and source related attributes in nutrition communication.

Recommendations: To tailor nutrition communication towards dietary supplement users, information needs to be presented in a plain way, in which risks are elaborated upon with support of data and references and in which a formal writing style is used. Advice needs to be practical, and unconventional channels should be used. Moreover, advice regarding supplements should be nuanced by stating that health is more than nutrition and that supplements do not define health on their own.

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Chapter 1: Introduction

1. Introduction

1.1 Dietary supplement use and nutrition communication

It has become evident that diets play a significant role in the rapid expansion of diet related chronic-diseases. Industrialization and economic development gave rise to more energy-dense food products – changing diets and lifestyles globally. Prevalence of chronic conditions like diabetes mellitus, obesity and cardiovascular disease sharply rose and still attribute significantly to premature deaths (WHO, 2003). As a response, governmental organizations put Dietary Guidelines in place to support the population's dietary management, and to deal with the issue that a proportion of the consumers sincerely believe that they eat healthily, which often is false (Dillen, Hiddink, Koelen, Graaf & Woerkom, 2003). The issues created by the shift in dietary patterns are embedded within a context that regards ecological (e.g. the food-environment), behavioral (e.g. consumption patterns) and societal features (e.g. societal norms) (WHO, 2003). Mass communication to promote responsible dietary practices towards the general public remains challenging due to the audience's individual characteristics (e.g. age, socio-economic status, culture and education). Moreover, nutrition communication can become ineffective (i.e. consumers falsely believe that they eat healthily) by an array of obstacles that is rooted in a social context. First, the public's perception of changes in dietary advice by officials lead to confusion of what constitutes a healthy diet (Goldberg, 2000). Cornish & Moraes (2015) showed that consumers may face anxiety when being frequently exposed to inconsistent advices on nutrition which leads to policy-led communication being received with cynicism. Second, consumer-confusion regarding nutrition can be partly sparked by the growing 'Blogosphere' (the collective term for media-platforms on the internet). Contradictory information regarding nutrition can be found in the blogosphere, especially information that is not in line with official guidelines. Bloggers frequently appeal to scientific evidence for proper rhetoric, and combine this with cultural and personal values to emphasize how small changes within a diet can lead to big effects in the consumer's personal life. A central proposition within the blogosphere is the individual understanding of healthy eating in contrast to population based research, which in turn stands central in policy-led nutrition communication (Huovila & Saikkonen, 2015). Lastly, the promotion of dietary supplements, especially those that deliver non-nutrient compounds, leads to an increase in dietary supplement use, which does not stand in line with the nutrition guidelines and could spark consumer confusion (Goldberg, 2000). Peters, Shelton & Sharma (2008) observed that frequent consumers of a diverse set of dietary supplements have strong attitudes towards dietary supplements, and that they are influenced by media with respect to the uptake of supplement use. Additionally, these consumers value self-education through media sources with respect to nutrition. The authors point out that used media sources might not be credible or valid regarding nutrition advice. Dietary supplement use is not necessarily risky, however, Palmer et al (2003) observed dire consequences associated with irresponsible dietary supplement use like seizures, myocardial infarction, comas, arrhythmias and hepatic disease. Furthermore, they observed a tendency to use supplements as treatment for diseases and replacements for mainstream drugs. This notion is supported by Timbo, Ross, McCarthy & Lin (2006), who add that approximately 73% of US adults use dietary supplements, and that 4% were subject to adverse effects attributable to supplement use. Except from toxic effects, dietary supplements might reduce healthy self-regulation habits of consumers (Chiou, Chin & Wan, 2011). Horst & Siegrist (2011) affirm this finding, however they add that consumers of dietary supplements might also use these in combination with an already healthy lifestyle, and hence might not be in need of dietary supplements. So in short, irresponsible dietary supplement use could result in toxic effects, a lesser regulation of health-behaviors or could just be unnecessary, and information regarding dietary supplements could result in irresponsible use of dietary supplements. Since information regarding nutrition can be found in a diverse amount of (online) platforms, and dietary supplement users frequently tap into these platforms for self-education, it remains paramount for official agencies to be able to clearly communicate the possible risks and functions of dietary supplements to the general

public. The academic community already mentions an array of methods and theoretical models that are impeccable for clear and effective communication. For example, Fineberg (1998) formulated a check list for researchers, journalists and other stakeholders to assess whether the content of their message was complete and contained enough context that would allow a wider audience to fully understand the message, and multiple authors refer to the use of communication models (Social Cognitive Theory; Social Ecological Theory; Theory of Reasoned Action; Planned behavior) as imperative to use, evaluate and adjust to design effective health communication programs (Snyder, 2007; Hornik & Kelly, 2007; Fitzgibben et al, 2007). While these methods may be promising, they are generic, and more specified nutrition communication might be beneficial for nutrition literacy. The concept of tailored health communication has been receiving increasing attention, and is said to be effective in communicating nutrition information when developed with an understanding of message effects with respect to a target group (Rimer & Kreuter, 2006). This includes the tailoring of formats, content based on information about the target group and information channels. To develop effective content that delivers information regarding nutrition and dietary supplement use to dietary supplement users, it is important to explore how users and non-users evaluate information regarding nutrition and dietary supplements specifically. This thesis aims to support effective communication regarding nutrition and dietary supplement use by exploring the general context that underlies the uptake of dietary supplement use and the means by which nutrition information is handled by users and non-users of dietary supplements. To guide this process, the following working hypothesis is formulated:

Dietary supplement users evaluate nutrition information the same way than non-users.

The following working hypothesis is derived from the presumption that dietary users and non-users could possibly follow different evaluation strategies and thus generate a different attitude towards dietary supplement use, as figure 1 illustrates.

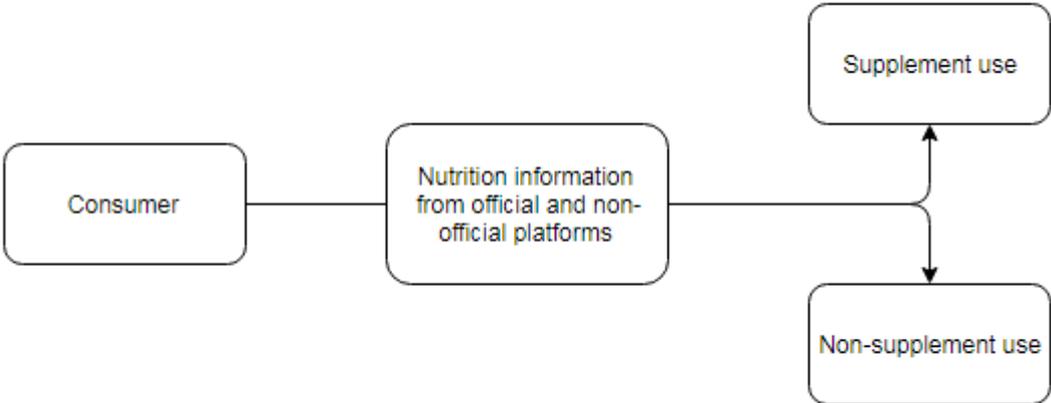


Figure 1 Communication pathway

1.2 Research question

Main research question:

How do users and non-users of dietary supplements evaluate nutrition communication?

Sub research questions:

1. What are characteristics of Dutch dietary supplement users?
2. How do Dutch dietary supplement users and non-users collect information about nutrition?
3. What evaluation criteria are applied by Dutch dietary supplement users and non-users regarding nutrition communication?

1.3 Theoretical framework

Heuristic-systematic model

The heuristic-systematic model will be employed within this research to analyze the used evaluating strategies from supplement users and non-users. Normally, this model is employed in experimental settings. In this thesis, concepts of this model are used to analyze how users and non-users evaluate nutrition information. Two elements stand central in this model: heuristic and systematic processing. In heuristic processing, an individual uses a quick rule of thumb to assess whether or not something is reliable or true. These rules are based on an individual's experience. For example, information coming from a source that has no significant background in the topic being discussed is deemed unreliable because of this. These quick decision rules, called heuristics, have a function. They allow a more easy and time-efficient evaluation process, which individuals find comfortable. However, there are instances in which these short decision rules will not be sufficient. For example when a topic is of great importance to us, or when something will have big consequences in our lives, then individuals need a greater amount of security in their judgement. In other words, when the stakes are high, individuals are struck with a greater amount of insecurity, and will tend to process more systematically. Systematic processing is characterized by greater elaboration of the supplied information to come to a sound judgement. Systematic processing is easier when individuals have enough time or knowledge to elaborate on the information. Both modes of processing can co-occur. In other words, individuals can elaborately engage information and use heuristics at the same time. When this happens, it is possible that both modes of processing lead to the same judgement (additivity), modes influence each other (bias) or, in case of systematic processing, heuristics will not have an effect (attenuation) (Chaiken & Trope, 1999).

This model will be used to analyze whether users will process information differently or the same as non-users. It will be used in three ways. First, this model will help interpret whether users and non-users process systematically or heuristically, which would ultimately lead to different judgements and attitudes regarding nutrition and dietary supplement use. Second, relating to the mode of processing, this model will help interpret whether users or non-users see supplement use and nutrition as important theme's in their lives. If either users or non-users see it as a major important theme, than this could explain possible systematic processing. Third, this model helps to identify the used heuristics, and whether users use different heuristics than non-users. Figure 2 illustrates the model. The translucent red area indicates the used concepts of the model. Other concepts, like the types of confidence, biases and motivations do not fall in the scope of this study.

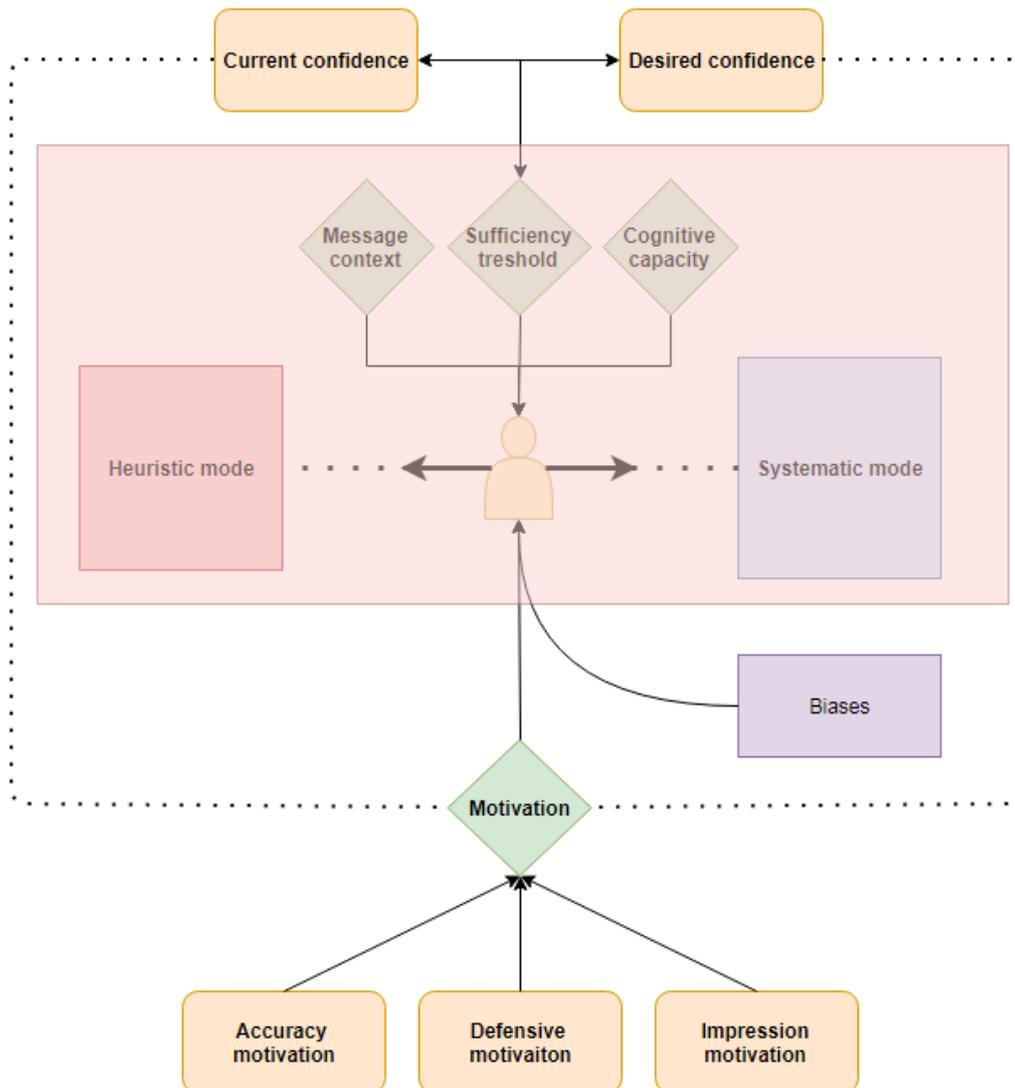


Figure 2 Heuristic-systematic model

Tailored communication strategies

Kreuter & Rimer (2006) emphasize the need for tailored health communication and add that – in accordance to the heuristic-systematic model – a degree of involvement has to be created among the target group to establish strong attitudes. The authors identified four elements that need to be included in tailored communication:

1. Matching content to the target group's needs;
2. A framing of the health information that captures the interests and needs of the target group;
3. A design that captures the attention;
4. Communicating information in a specific type and amount and through specific channels.

In accordance to Kreuter & Rimer's elements, message qualities can thus be distinguished in four concepts: 1) the source, 2) the content, 3) the format and 4) the used channel.

Currently, the academic literature predominantly presents us general determinants of message credibility. Firstly, the current academic stance regarding source related factors in nutrition communication regards the concepts of expertise and trustworthiness. In other words, sources can be evaluated on the basis of their know-how about a particular subject or on the basis of more general characteristics such as liking or honesty. High credible sources are generally only effective when the topic discussed is less relevant to the audience. Moreover, source similarity and attitudinal similarity are two factors that influence credibility, but then again under lower involvement. Secondly, regarding content, giving a firm and explicate conclusion increases credibility among higher and lower involved readers. Moreover, two-sided messages are more persuasive when the opposite arguments of the message conveyed is refuted. When opposite arguments of a two-sided message are not refuted, the message is perceived as less credible. Additionally, fear-appeals are used in nutrition communication, in which strong fear appeals are effective in persuasion, but only if readers perceive the treat as manageable, real and that they are vulnerable to it. Lastly, the use of statistics and examples result in ambiguous effects i.e. can affect credibility positively or negatively (Wilson, 2007). Third, aesthetics and a pleasurable format can increase credibility. However, the effect of aesthetics may be dependent on the processing type of the reader. Readers that process heuristically may find aesthetic pleasurable formats more persuasive than individuals that process systematically (Robins & Holmes, 2008). Fourth, Kreuter & Rimer (2006) state that the communication channel should be tailored to target group. By this, tailoring the communication channel could enhance the target group's available time to think about the message, which might increase systematic processing.

Chapter 2:
Systematic literature
review

2. Systematic literature review

First, a systematic literature review was used to expand on the theoretical basis to support the answers to all three sub questions. Following sections will first describe the methodology of the systematic literature review, followed by the results.

2.1 Systematic literature methodology

This literature review focusses on three aspects: 1) the characteristics of dietary supplement users; 2) methods of information gathering of nutrition and health information and 3) the evaluation strategies for nutrition and health information.

Exclusively Scopus was used for all three sub questions because it offers a broad range of medical-social articles, is free accessible, offers advanced search options and is less algorithm driven. This in contrary to for example pub-med (medically focused) and Google scholar (algorithm driven). Individual search actions regarding all three sub questions will be further discussed.

2.1.1 Characteristics

The review firstly focused on describing characteristics of dietary supplement users. Articles were selected with respect to attributes like socio-economic determinants (education, income, occupation), sex, age, area of inhabitation, motivations and health-orientations.

Inclusion criteria

- Studies after 1999
- Studies that were accessible free of charge
- Studies that regarded dietary supplement use

Exclusion criteria

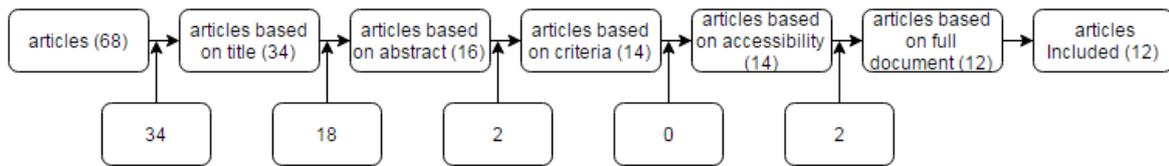
- Studies that regarded supplement use for athletic purposes
- Studies that regarded supplement use for strict medical reasons exclusively
- Studies that regarded supplement use for macro-nutrients exclusively
- Studies that regarded exclusively children
- Studies from before 2000

Studies regarding athletes/athletic purposes were excluded because users with this purpose would likely show a very clear motivation that is deviant from the 'general health seeker'. The same applies for users for strict medical reasons. Macro-nutrients were excluded because these do not apply within the problem definition. Children were excluded because these are less likely to use supplements out of their own motivation.

Used search terms:

Allintitle:	Information	AND	"Dietary supplements"
	Characteristics	AND	"Dietary supplement users"
	Dutch	AND	"Dietary supplements" AND Determinants

Search results:



A total of 68 search results were generated, 12 articles were included in the review. One of these articles was additionally applicable to sub question three. Another article was not applicable to sub question one, but was applicable to sub question two.

2.1.2 Information collection

Second, articles were selected that discussed the information collection methods and channels used by individuals. Information collection methods regarded the way by which information is looked up and the used information channels regarded the different sources which were used.

Inclusion criteria

- Studies after 1999
- Studies that were accessible free of charge
- Studies that describe the process of acquirement
- Studies that describe the channels of acquirement
- Studies that regard health

Exclusion criteria

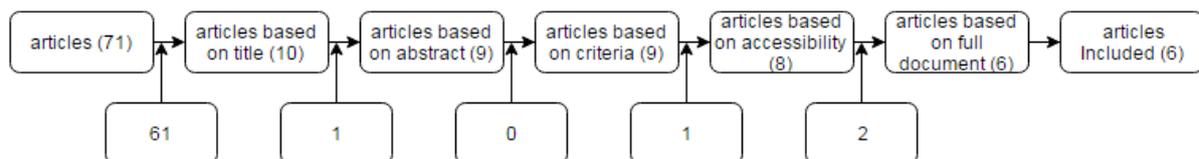
- Studies from before 2000
- Studies that regard single healthcare provider and patient interaction

Studies that exclusively focused on healthcare provider and patient interaction were excluded due to the to narrow scope of this topic.

Used search terms:

“Information seeking strategies”	AND	Health
“Information channels”	AND	“Health information”

Search results



A total of 71 articles were generated, 6 were included in the review. One article was additionally applicable for answering sub question three.

2.1.3 Evaluation strategies

Third, the review focused on strategies used by individuals to evaluate health related information. Search strategies regarding this topic focused on acquiring information reflecting the three former discussed dimensions of content, format and source credibility.

Inclusion criteria

- Studies after 1999
- Studies that were accessible free of charge
- Studies that described source, format or content credibility

Exclusion criteria

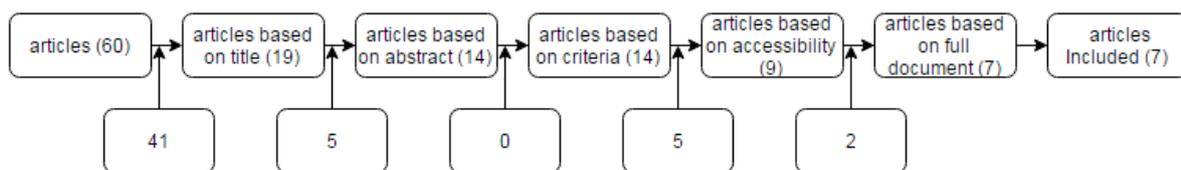
- Studies that exclusively regard the reading of labels
- Studies that deal with credibility across ethnicities
- Studies from before 2000

Studies regarding the influence of reading labels were excluded because processing this information can be regarded a construct on its own when taking understandability and readability into account. Studies that deal with credibility across ethnicities were excluded because of its too narrow scope, and it's presumed that there is no significant relation between ethnicity and being a source for nutrition communication. Studies from before the year 2000 were not incorporated to exclude outdated information.

Used search terms:

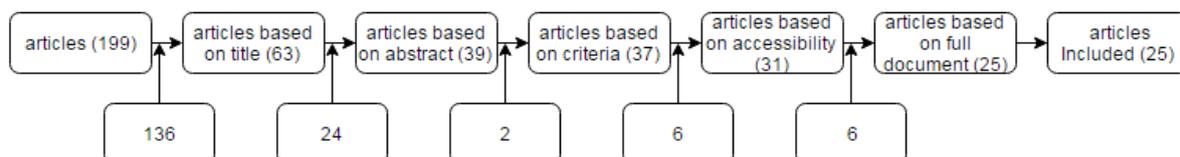
Message	AND	"Dietary supplements"	AND	Judgement
Message	AND	"Dietary supplements"	AND	Content
Health	AND	"Source credibility"	AND	Messages
Message	AND	Aesthetics	AND	Credibility
Media	AND	"Dietary supplements"		
Nutrition	AND	"Source credibility"		
		"Content credibility"		

Search results:



A total of 60 articles were generated, 7 were included in the review. Additionally, one article was found when searching for characteristics and one when searching for the information acquirement methods of dietary supplement users.

Total search results:



Search strategies yielded 199 results in total. On basis of the title, 63 results were selected. After evaluating the abstract, 39 articles were selected. Selection on the basis of criteria was synchronous with the evaluation of the abstract, however two articles appeared to be outdated and were excluded. Six articles were inaccessible, and six articles were excluded after reviewing the whole document. Finally, 25 articles were included in the review.

2.2 Systematic literature results

The systematic literature review was conducted to gain more insight in what characteristics are of dietary supplement users, how they look up information and how individuals evaluate nutrition information with respect to content, format and source related attributes. This section will discuss the results that are applicable to all three sub questions, however, due to the availability in academic literature, the evaluation strategies and information acquirement methods will be discussed with respect to the general population instead of users and non-users of dietary supplements specifically and predominantly regards general health information instead of nutrition communication.

2.2.1 Characteristics

The first aim of the systematic literature review was to explore and describe the characteristics linked with dietary supplement use. Searches yielded a rich number of factors that dealt with the characteristics of users. Characteristics were clearly distinguishable in three dimensions. First, socio-economic status was a category employed by authors to tap into the concept of dietary supplement use. Second, demographic characteristics were intensively used to describe dietary supplement users. Third, research towards characteristics of dietary supplement users additionally focused on health-related orientations. These three dimensions: (1) socio-economic status, (2) demographics and (3) health related orientations will be discussed with respect to dietary supplement use.

Socio-economic status

Eight of eleven included studies included socio-economical attributes to describe dietary supplement users. Socio-economic status was predominantly measured by education and income. Professional occupation was a third variable used to measure socio-economic status, although the three studies that included professional occupation in their analysis measured it on different scales (e.g. occupational sector, employment vs self-employment, manual vs non-manual). Lastly, marital status was linked to supplement use in two studies. Marital status can be classified as a demographic variable or can be put under the heading of SES. In this review, marital status is treated as a component of SES, while marital status may be deemed as a contributing factor to social support (Holt-Lunstad, Birmingham & Jones, 2008). Table 1 shows the adjusted odds ratios divided among the attributes education, marital status, income scale and manual/non-manual profession.

Education

Education was measured in four cross-sectional surveys and was mentioned in two reviews. Four studies showed a positive association between education attainment and the use of dietary supplements. One study, conducted by Robson, Siou, Ullman & Bryant (2008), distinguished between the types of dietary supplements used by respondents (e.g. vitamins, specific minerals, herbal and other supplements or combinations of the three). Generally, a significant positive association was observed between education attainment within men, but not in women. Higher educated men were more likely to use supplements from all categories that included multivitamins, which also included specific nutritional supplements and herbal/other supplement combinations. Higher educated women on the other hand, were more likely to just use multivitamins. All other categories showed a negative association between education attainment and dietary supplement use in women within this study. A review conducted by Dickinson & Mackay showed that a higher education is associated with dietary supplement use. In the work of Brownie (2015) it was concluded that education attainment shows a positive relation with dietary supplement use. However, in this review, the discrepancy between higher educated men and women and their respective dietary supplement use is again pointed out, in the sense that education attainment can have a gender specific relation.

	Sample	N	Education ¹			Marital		Income ²		Manual profession	
			OR	relation		OR	relation	OR	relation	OR	relation
<i>Jong, Ocké, Branderhorst & Friele (2003)</i>	Netherlands	1183	1.88*	+		1.35*	+	1.32	+		
<i>Robson, Siou, Ullman & Bryant (2008)³</i>	Canada	12506	1.2	0.8	+/-	0.6*	0.8*	-			
<i>McNaughton, Mishra, Paul, Prynne & Wadsworth (2005)</i>	UK	1776								0.68* ⁴	-
<i>Lee & Kim (2009)</i>	Korea	4775	1.50	+				1.89*	+	0.72 ⁵	-
<i>Kim, Lee, Shin, Kang, Shin, Chung & Kim (2003)</i>	Korea	1529	1.25	+				1.69*	+		
<i>Ishihara, Sobue,, Yamaoto & Tsugana (2003)</i>	Japan	78531									-
<i>Dickinson & MacKay (2014)</i>				+					+		
<i>Brownie (2005)</i>				+					-/+		-

Table 1 Socio-economic status

OR and relations of dietary supplement use and social economic status.

* indicates significance, at least (P<0.05).

OR's are adjusted were possible.

¹ Odds ratio from highest educational attainment class

² Odds ratio from highest income scale

³ Odds ratio from supplement category multivitamins,, specific nutritional & herbal/other supplements (male/female)

⁴ Odds ratio for women, OR men = 1.00

⁵ Odds ratio from the laborer and agriculture category. Other categories were office worker (nonmanual), sales, service (nonmanual), unemployed and housewife.

Marital status

Two studies linked dietary supplement use to marital status. Surprisingly, both studies seem to contradict one and other. Jong, Ocké, Branderhorst & Friele (2003) observed a positive significant relation between marital status and dietary supplement use, in which married individuals were 1.35 times more likely to use dietary supplements than non-married individuals. However, Robson, Siou, Ullman & Bryant (2008) observed a general significant negative relation between marital status and dietary supplement use. In men, married respondents were less likely to use dietary supplements among all supplement categories. Married women were somewhat more likely to use multivitamins, specific nutritional supplements and herbal/other supplements but were as likely or less likely to use a combination of these three.

Income

Five studies incorporated income into their survey or review. Overall, all five studies conclude that there is a positive association between monthly income and dietary supplement use. Interestingly, a stronger association was seen in the studies conducted among Korean samples than among the Dutch sample. Dickinson & MacKay (2014) remark that higher income leads to more dietary supplement use in their review. However, Brownie (2005), mentions that, with respect to elderly dietary supplement users, the association of income and dietary supplement use tends to diminish with age. Moreover, the author mentions that a lower income contributes towards dietary supplement use among elderly in one of the included studies, and offers an explanation that involves 'nutritional insurance', the compensation for reduced capacity to meet nutritional demands among lower earners.

Manual profession

Four articles considered the relation between an individual's profession and dietary supplement use. In two cross-sectional surveys, and one cohort study, it was concluded that having a profession which involved manual labor diminished the likelihood of using dietary supplements. A study by Lee & Kim (2009) showed that housewives and labor/agricultural employees were less likely to use dietary supplements than office workers and sales/service workers. Moreover, employees in farming, fishery and forestry were least likely to use dietary supplements while self-employed individuals were most likely to use dietary supplements, which may relate to prestige gained from one's occupation. Whether this indicates manual labor or non-manual is unclear (Ishihara, Sobue, Yamaoto & Tsugana, 2003). Lastly, Brownie (2005) confirms previous findings and mentions that occupation status positively contributes towards dietary supplement use. However, the study conducted by McNaughton et al. (2005) showed that men who performed manual labor were as likely to use dietary supplements than men who had a non-manual profession, while women who performed manual labor were less likely. In general, having a non-manual occupation diminishes the likelihood of dietary supplement use, however this relation can be moderated by gender.

To sum up, income and occupation are the best predictors of dietary supplement use within the dimension of social-economic status. While the relation between income and dietary supplement use could differ among age categories, most results support this relation in general. Results regarding marital status and dietary supplement use are ambivalent. Results regarding education seem generally consistent and point towards a positive relation regarding dietary supplement use, however, it is possible that this relation is moderated by gender. In conclusion, previous findings support the notion that dietary supplement users enjoy a higher socio-economic status than non-users.

Demographics

Nine of the eleven included studies incorporated clear demographic variables within their results. While many variables can fall under the term demographic, in this literature review, age, gender and place of residence are deemed as the demographics of interest. Table 2 presents the findings regarding age and gender. The table denotes gender as 'being female', to illustrate the odds of dietary supplement use when being female. Area of residence is not included within the table because the articles regard different countries and used different answering scales. Regarding the measurement of age and gender, no special differences were found, as would be assumable. Two of the nine articles regarded reviews, of which one exclusively deals with elderly dietary supplement users. Six of these articles are cross-sectional surveys, and one article regards a five-year follow-up cohort study

	Sample	N	Age ⁶		Being female	
			OR	relation	OR	relation
<i>Jong, Ocké, Branderhorst & Friele (2003)</i>	Netherlands	1183	0.62*	-	2.02*	+
<i>Brownie & Rofle (2004)</i>	Australia	1263				+
<i>McNaughton et al. (2005)</i>	UK	1776				+
<i>Lee & Kim (2009)</i>	Korea	4775	1.28	+	1.44	+
<i>Kim et al. (2003)</i>	Korea	1529	4.48*	+	1.92*	+
<i>Rozga et al. (2013)</i>	USA	637	2.04*	+	2.48*	+
<i>Ishihara, Sobue,, Yamaoto & Tsugana (2003)</i>	Japan	78531	2.05* ⁷	1.73*	+	
<i>Dickinson & MacKay (2014)</i>					+	+
<i>Brownie (2005)</i>						+

Table 2 Demographic

OR and relations of dietary supplement use and demographic variables

* indicates significance, at least (P<0.05).

OR's are adjusted were possible

Age

Age has been clearly measured or mentioned in seven included articles. Results were partly consistent, in the sense that significant relations were found between an increase in age and the odds of using dietary supplements. Dickinson & MacKay (2014) affirms these findings in their review. However, one study conducted by Jong, Ocké, Branderhorst & Friele (2003) found that the oldest age category (65 years and older) was almost half as likely (OR=0.62) to use dietary supplements than the reference category (19-34). Within this study, individuals of the age 35-49 were most likely to use dietary supplements (OR=1.43). This deviating finding might be the effect of the study being more outdated than e.g. Rozga et al. (2013) and of the difference of the sample (e.g. Caucasian vs Asian). To summarize, age seems to show a positive relationship with dietary supplement usage.

Gender

Consistent results have been found with respect to gender and dietary supplement use. Eight articles that clearly incorporated gender in the results showed a strong positive relationship between being female and using dietary supplements. It seems that being female is one of the best predictors of dietary supplement use.

⁶ Odds ratio from oldest age category

⁷ Male - Female

Area of residence

Three studies clearly described the area of residence of dietary supplement users. Kim et al. (2003) observed that residents of small cities (OR 0.88) and rural areas (OR 0.69) are significantly less likely to use dietary supplements than residents of large cities (reference). This finding is confirmed by Lee & Kim (2009). Additionally, Ishihara, Sobue, Yamaoto & Tsugana (2003) state that there was a higher prevalence of dietary supplement use in metropolitan areas or areas that were increasingly influenced by Western culture.

To summarize, results regarding age were generally consistent except for the one study. In this sense, dietary supplement use seems to increase with age. Gender appeared to be a significant predictor, in the sense that being female was consistently related to using dietary supplements. Lastly, there are indications that urban dwellers are more likely to use dietary supplements than inhabitants of small cities and rural areas.

Health related orientations

All included articles incorporated findings regarding health related orientations. Findings could be grouped within three sub dimensions. First, the sub dimension of restraint, which included the amount of exercise, smoking and alcohol intake. Second, the sub dimension that regards dietary behaviors, which included dietary quality and BMI. General health was the third sub dimension which could be identified, and included self-rated health and whether respondents were diagnosed with a disease or experienced symptoms. Table 3 includes all found relations within these three sub dimensions. Odds ratios were not included because there was great diversity among the studies regarding the measurement of the related attributes. Moreover, answering scales were diverse among the included articles. Dietary quality for example was measured by vegetable intake in one study, and by fiber, vegetable and fat intake in another. The same applied to alcohol intake, exercise, self-related health and diagnostic characteristics. First, restraint related characteristics will be discussed. Second, dietary quality will be elaborated upon and conclusively, results regarding general health related characteristics will be discussed.

Restraint

Restraint covers the habits of smoking, exercise and alcohol consumption. First, results regarding smoking behavior will be discussed. Second, results regarding exercise will be given and third, results regarding alcohol intake will be elaborated upon.

Smoking

Smoking behavior was extensively considered in the selected articles. Five cross-sectional surveys and one five-year follow-up cohort study showed that smoking is negatively associated with dietary supplement use. Individuals who had never smoked, or quit smoking, were more likely to use dietary supplements than individuals who did smoke. These findings were also confirmed by the reviews conducted by Brownie (2005) and Dickinson & MacKay (2014). However, the study conducted by Jong, Ocké, Branderhorst & Friele (2003) found a positive association between smoking and dietary supplement use (OR 1.11). While this insignificant difference might suggest a different relation, the general consistently for the negative association among the other included studies cannot be overlooked. Overall, it can be concluded that dietary supplement users are more likely to have never smoked or to have quit smoking.

Exercise

Five of the included articles reported a positive relation between the amount of exercise undertaken and the odds of using dietary supplements. Jong, Ocké, Branderhorst & Friele (2003) reported a negative association between amount of exercise and dietary supplement use (OR 0.68, > 4

hours/day). Lee & Kim (2009) reported that only medium physical activity showed a lesser likelihood of dietary supplement use, while odds for low- and high physical activity remained equal. However, the five findings which indicated a positive relation, of which three significant, and the confirmation of Dickinson & MacKay (2014), reveal a fairly consistent pattern indicating that frequent exercise is positively linked to dietary supplement use.

Alcohol

Mixed results were found regarding alcohol use. Five included articles presented a negative relation between alcohol use and the use of dietary supplements. In other words, frequent alcohol consumers were less likely to use dietary supplements. However, two studies, Kim et al. (2003) and Rozga et al. (2013), showed that alcohol consumers were more likely to use dietary supplements. Brownie (2005) notes that no significant relation could be found between alcohol use and dietary supplement use among elderly users, but that there are indications towards a negative relation. While the overall tendency appears to be that dietary supplement users tend to be moderate- to non-drinkers, Dickinson & MacKay (2014) supply us with a possible explanation for these mixed observations. They observed that wine drinking was possibly positively associated with dietary supplement use, while there was no relation with beer drinking. Additionally, consumers of distilled spirits were more likely to use dietary supplements. It was thus hypothesized that this relation may be linked with socio-economic status.

Nutrition

The second sub dimension regards characteristics regarding nutrition. The two related attributes regard dietary quality and BMI. First, dietary quality will be elaborated upon. Second, the relation between BMI and dietary supplement use will be discussed.

Dietary quality

Five studies assessed the link between dietary quality and dietary supplement use. Robson, Siou, Ullman & Bryant (2008) and McNaughton et al. (2005) observed that both male and female users were more likely to eat more fruit & vegetables, to consume more whole grain foods and to have a lower fat intake. This stands in contrast to the findings of Jong, Ocké, Branderhorst & Friele (2003), who observed that moderate- to high consumers of vegetables were less likely to use dietary supplements than low consumers. However, both review articles reference that dietary supplement users employ healthier eating habits than non-users.

BMI

Findings regarding BMI were fairly consistent and showed that BMI is negatively associated with dietary supplement use. Lee & Kim (2009) observed a positive trend between dietary supplement use and BMI. Pajor, Eggers, Oenema & Vries (2017) observed a significant, yet very small relation (OR 0.99), between a lower BMI and dietary supplement use. Both reviews proposed that dietary supplement users are more likely to have a lower BMI. Findings can thus be regarded consistent with the notion that dietary supplement use is related to having a lower BMI

	Sample	N	Restraint			Nutrition		General health	
			Smoking	Exercise	Alcohol	Diet	BMI	SRH	Diagnoses
<i>Jong, Ocké, Branderhorst & Friele (2003)</i>	Netherlands	1183	+	-	-	-		-	
<i>Brownie & Rofle (2004)</i>	Australia	1263						+/-	+/-
<i>McNaughton et al. (2005)</i>	UK	1776	-	+	-	+			
<i>Lee & Kim (2009)</i>	Korea	4775	-	+/-	-		+	+/-	+/-
<i>Kim et al. (2003)</i>	Korea	1529	-	+*	+		-	+/-	+*
<i>Rozga et al. (2013)</i>	USA	637	_*	+*	+		_*		
<i>Pajor, Eggers, Oenema & Vries (2017)</i>	Netherlands	1161					+/-		+*
<i>Robson, Siou, Ullman & Bryant (2008)</i>	Canada	12506	-	+*	-	+*	-		
<i>Ishihara, Sobue,, Yamaoto & Tsugana (2003)</i>	Japan	78531	-		_*		_*		
<i>Dickinson & MacKay (2014)</i>		Review	-	+	+/-	+	-		+
<i>Brownie (2005)</i>		Review	-		+/-	+	-	+/-	+

Table 3 Health related orientations

* indicates significance, at least (P<0.05).

General Health

The third dimension regards general health. The two related attributes within this dimension regard the self-rated health status and the degree to which respondents were diagnosed with a (chronic) condition or experienced any symptoms. First, the self-rated health status will be discussed. Second, the diagnostic characteristics will be given.

Self-rated health status

Results regarding self-rated health (SRH) status showed ambivalence. Jong, Ocké, Branderhorst & Friele (2003) observed that a better SRH status was not particularly related to dietary supplement use. Brownie & Rofle (2004), Lee & Kim (2009) and Kim et al. (2003) reported no consistent findings that indicate a relation between SRH status and dietary supplement use. Brownie (2006) evens the playing field by stating that there are indications of an association between self-rated health status and dietary supplement use, but that it is not a good predictor.

Diagnoses

Six articles incorporated results with respect to diagnoses of illnesses and symptoms. In general, being diagnosed or experiencing symptoms is a predictor of dietary supplement use. Brownie & Rofle (2004) observed that older dietary supplement users were more likely to be diagnosed with osteoporosis and arthritis and to suffer more symptoms. However dietary supplement use seemed to depend on the health condition, as individuals with hypertension had a lesser likelihood of using dietary supplements. Both Kim et al. (2003) and Pajor, Eggers, Oenema & Vries (2017) observed significant relations between dietary supplement use and being diagnosed with a chronic condition. Dickinson & MacKay (2014) add that it might not necessarily be a matter of starting with dietary supplements after a diagnosis, but that dietary users that are diagnosed with a chronic ailment use dietary supplements more frequently. In general, dietary supplement use may be dependent on the type of condition and on previous experience with dietary supplements

To conclude, dietary supplement users may show more constraint when it comes to health-related behaviors as smoking, exercise and alcohol use. Moreover, there is a strong indication that dietary practices of supplement users are healthy in general. Lastly, self-rated health status is not an effective predictor of dietary supplement use, and being diagnosed with a chronic disease may be related to dietary supplement use, but it is also likely that it affects the amount of supplements used.

Conclusion: characteristics of dietary supplement users

Within this review, efforts were made to categorize the characteristics of dietary supplement users. In general, dietary supplement users enjoy a higher social-economic status than non-users. Social-economic status might also be related with urban residency. Additionally, users tend to be female and are of higher age. Looking beyond social-economic status and demographics, we can conclude that dietary supplement users show a higher restraint when it comes to health-related behaviors and dietary practices. From another perspective, being diagnosed with a chronic disease could also lead to dietary supplement use or more frequent use. In general, these findings could indicate that dietary supplement use in general is driven by cultural and social norms as the result of a high-economic status or a self-efficiency regarding health. Pajor, Eggers, Oenema & Vries (2017) additionally found that dietary supplement use within an individual's direct social environment leads to a more likely adoption of dietary supplements. Hence an interesting interpretation could be that dietary supplement use is an expression of a general healthy lifestyle. This review contained limitations. First, mainly cross-sectional surveys were included. Sample sizes ranged between 1,183 and 12,506 respondents. Additionally, populations ranged in ethnicity, including samples from Western cultures (Netherlands, United Kingdom, Canada, Australia) and Asian cultures (Korea, Japan). While these gave

an extensive image of the characteristics regarding dietary supplement use, they did not incorporate time effects or causal relations. One cohort study was included, however, this study only included two distinct data waves. Clear comparisons were not made within this cohort study. Results within this review also relied on the results found in two other reviews. These reviews frequently validated findings gained from the cross-sectional surveys.

2.2.2 Information collection

The second aim of the systematic literature review was to identify the ways individuals collect information regarding nutritional supplements and what channels are used to acquire information. In this section, these two themes will be explored. Eight articles were incorporated in this part of the review. Authors employed a variety of research designs, including experimental- and cross-sectional research designs in which both quantitative and qualitative data were acquired. Most studies focused on general health information instead of dietary supplement use and nutrition specifically. First, the information collection methods will be discussed. Second, the information collection channels will be elaborated upon.

Information collection methods

Four articles incorporated findings regarding information collection methods. In an experiment conducted among 78 young adults by Perez et al. (2015), it was observed that participants had four distinct strategies. The authors paid attention to whether respondents were gathering information, testing the information (hypothesis), or were seeking for an action/treatment. First, the most basic search strategy regarded a simple search, which confined itself to just gathering evidence, testing a hypothesis or action/treatment seeking but no combination of the three. The remaining three strategies all incorporated combinations of evidence gathering, hypothesis testing and action/treatment seeking. The intuitive strategy skipped right to seeking information about possible actions and subsequently sought information for hypothesis testing. The two remaining strategies incorporated a more analytical approach. The analytical-recursive strategy users first gathered evidence and tested hypotheses, but did not search for actions or treatments. The analytical-methodical strategists first gathered evidence, tested hypothesis and conclusively sought for actions or treatments. Most participants employed a more analytical search strategy (59%), while 41% employed a simple or intuitive search strategy. The authors concluded that those who were younger and/or had a higher education were more likely to employ analytical search strategies. Moreover, in a different article regarding the same study sample by Peretz, Kravitz, Bell, Chan & Paterniti (2016), it was found that search strategies are led by specific decision rules, which relate to previous education and experiences. They observed that participants who had a lower-ses were more likely to use intuitive search strategies, in contrast to higher-ses individuals, who employed more complex search strategies. Lower-ses individuals used certain decision rules to narrow down their searches, and ignored or removed topics that did not appear to be related with the task at hand. However, Kim, Park & Bozeman (2011) showed that the employment of simple search strategies could rather indicate familiarity with the subject. They observed that participants who were familiar with the topic and were highly confident visited a single website which they deemed as an efficient source. Moreover, in interviews among women who searched for menopause related information, conducted by Genuis (2012), it appeared that participants adopted an analytic approach to obtain information. They were focused on exploring logical connections between health information articles, and employed conscious considerations to link information acquired from different sources. However, some women also adopted a more intuitive stance, based on intrapersonal experiences, to filter out information. The author argues that both stances were not mutually exclusive, and that both the intuitive and analytic stance were employed to acquire information. Furthermore, during their searches, participants were eager to collect parallel evidence among the different consulted sources, instead of just compiling information. It would thus appear that information consistency is an employed strategy when searching for information. This strategy was more prominently applied by women who tried to make sense of formal, informal or interpersonal sources. Table 4 illustrates the previous findings regarding information collection.

Search strategies	Simple	Intuitive	Recursive	Methodical
Determinants	Age	Socio-economic status	Education	Familiarity
Heuristics	Narrowing scope		Parallel evidence	

Table 4 Information collection

Information collection channels

Five included articles incorporated findings regarding used channels for health information. First, Chen, Lee, Struabhaar & Spence (2014) observed that information collection repertoires regarding health information are related to an individual's social capital, media access and digital resources. Findings indicated that two-thirds of the participants relied on multiple information channels, and that approximately 30% relied on only one channel for health information. Within the population that employed multiple channels, a two-channel usage was most commonly seen, which included the internet and interpersonal sources. The internet was the most used channel among single-channel users. Furthermore, internet users were less likely to use television as a source. Less-skilled internet users were more likely use interpersonal contacts as an information source. Manierre (2016) investigated whether channel-use was dependent on what they call 'flexible resources' (FR) (e.g. knowledge, money, prestige, power and social connections). They observed that the internet was the most used channel, followed by friends and medical professionals. Low flexible resource individuals did not greatly differ from individuals with high flexible resources, other than that low FR individuals were more likely to start health information seeking behavior in offline channels. Syn & Kim (2013) argue that adolescents are more likely to use the internet, parents or friends as information sources. Rozga et al. (2013) observed a wide array of used sources in their study. Most common used information channels were physicians, after which books, magazines, the internet, labels, family and friends and healthy food retailers were used sources for dietary supplements specifically. Brownie (2005) additionally found that older dietary supplement users found knowledge by newspapers and printed information given by family members or friends. Moreover, physicians were a source for information regarding dietary supplements for older users.

Channels Internet Printed media Television Contacts Physicians

Determinants Age Available resources Social factors

Table 5 Information channels

Conclusion: information collection

To summarize, when looking for health information, individuals employ both systematic and heuristic modes of information processing to collect wanted information. The search strategies that are employed could relate to educational background. Search strategies could also be more direct when having confidence and previous experience with the topic. Individuals looked for parallel evidence between different sources, and again depending on educational background, could employ heuristics to narrow down the scope of the search topic. Internet, interpersonal relations and physicians were the most used channels for information regarding health in general and dietary supplement use. Findings can be related back to the heuristic-systematic model, in the sense that individuals can both apply a heuristic or systematic mode of information processing and that they are motivated to hold

accurate knowledge about a subject. The used channels regard both ordinary friends and family members as well as physicians. This leads to speculate that again whether sources can have a high credibility depending on what and how information is given. Cross-validation and finding parallel evidence among sources could possibly be the motivation for looking into both formal and informal channels for information. Like the heuristic-systematic model states, an individual is looking for a certain degree of confidence. The heuristic of parallel evidence might be employed to enhance confidence in a more economical way.

This section in the review had some limitations. Most included studies employed a cross-sectional or experimental design. The studies that related to search strategies used an experimental design. Hence the findings that indicated the use of heuristics and systematic processing would have a high validity, however, whether the same patterns would be seen in a real life situation is not clear. The interviews that supplied information regarding the analytical and intuitive stance among women are prone to respondent-, recall-, and interviewer biases. The cross-sectional surveys that assessed the selected channels and related resources are prone to respondent bias and are unable to predict age and time effects. Although the review was prone to these limitations, findings were affirmed across the included articles.

2.2.3 Evaluation strategies

The third aim of the systematic literature review regarded sub question three, which regards the used evaluation strategies for nutrition or health information. The search strategy yielded nine articles that were applicable to this research question. Authors mainly employed (quasi)experimental research designs to assess the evaluation strategies, additional to one literature review and a cross-sectional design. Samples did not include dietary supplement use specifically, however, most considered health information. Three themes regarding evaluation strategies are identified in this review: (1) format, (2) content and (3) source. First, evaluation strategies considering the format of health messages will be discussed. Format in this review is perceived as attributes regarding lay-out, aesthetics, graphical representation and ease of use. Second, content related evaluation strategies will be elaborated upon. In this review, content relates to attributes like discourse and argumentative quality. Third, source related credibility will be discussed.

Evaluation of format

Four articles considered the evaluation of format related attributes. A literature review from Bahry, Masrom & Masrek (2016) considered format being part of the evaluation strategy. They proposed that format relates to appearance/presentation, design, organization of the information, aesthetics and characteristics with respect to usability and interface. Format related characteristics are the first attributes evaluated when judging credibility. Web-based content is evaluated more favorably when having attractive fonts, colors, imagery, a clear layout and easy interaction. These findings are affirmed by Kim, Park & Bozeman (2011). In an observational study conducted under undergraduate students, they observed that a first impression of web-based content is derived from the site's aesthetics. Lay-out, ease of access and coloring were determining factors of first-impression credibility. When observing web-based content more intensively, the presence of advertisements was said to diminish the site's credibility, and that a well-organized interface which allowed easy navigation and easily accessible information increased perceived message credibility. Multimedia features like pictures and audio-video files increased the perceived quality of information, while too much features rather diminished the perceived quality. One of the most valued attributes was whether useful information was presented on the first page. Johnson, Sbaifi & Rowley (2016) conducted a cross-sectional survey among first and third year students regarding their evaluation repertoire. Results showed a repertoire consisting out of six factors for first year's students and a repertoire of seven factors among third year students. For first year students, ease of use was the first prominent factor

that contributed to web-content’s credibility. The style of the content was included within the decision-making repertoire of first-years, however it was one of the last attributes employed to evaluate credibility. In contrast, third-year students valued ease of use and style to a lesser degree, in the sense that these attributes stood in fourth and sixth place respectfully. Lastly, Robins & Holmes (2008) employed an experimental research design to assess the link between web-site aesthetics and credibility. They observed, as they call it, the amelioration effect, which entails that content is perceived more credible in a more aesthetically pleasurable format. Judgments based on web-site aesthetics were made quite swiftly. However, they argue that this effect may be moderated by experience with the content. In other words, being more knowledgeable with the actual information may result in lesser dependence on aesthetics to evaluate credibility. Table 6 shows the found heuristics regarding format.

Found heuristics regarding format		
Attractive fonts	Colors	Imagery
Clear lay-out	Aesthetics	Advertisements
Well-organized interface	Multimedia features	First page content
Ease of use	Style of content	

Table 6 Heuristics format

Evaluation of content

Four articles considered content related attributes within the evaluation of health communication. Bahry, Masrom & Masrek (2016) argued that content credibility was evaluated by authenticity, degree of consistency, focus, accuracy, popularity and insightfulness. In an experiment conducted by Dong (2015), it was observed that the form of content presentation influenced a message’s persuasiveness. Secondary high school students were given a message with either an informative text or a testimonial text from different sources (expert, celebrity and ordinary person). Findings indicate that the effectiveness of the content discourse was dependent on the source. Informative messages were least credible when given by an ordinary person, and most credible when given by an expert. In contrast, testimonial messages were most credible when given by an ordinary person, and less credible when given by an expert or celebrity. Moreover, in an experiment conducted by Haard, Slater & Long (2004), the effect of scientific jargon and referencing was analyzed under students with an academic and non-academic background. There was no significant relationship between having an academic background and the effect of scientific jargon and referencing on message persuasiveness. However, the use of scientific jargon in health messages increased message credibility in both groups. Referencing to scientific studies did as well, while it did not matter whether sources/institutions were specifically mentioned. In the previous mentioned study from Johnson, Sbaffi & Rowley (2016), findings indicated that content related attributes such as its perceived objectivity, comprehensiveness and accuracy were highly valued within the evaluation repertoire of students. Moreover, it appeared that third-year students were more likely to evaluate a message based on content than first-year students. Likewise, third-year students paid more attention to the objectivity, quality and impartiality of information, in contrast to first-year students, who did not incorporate these credibility cues in their repertoire. Table 7 shows the found heuristics regarding content.

Found heuristics regarding content		
Authenticity	Degree of consistency	Focus
Accuracy	Popularity	Insightfulness
Informative	Testimonial	Scientific jargon
Referencing	Perceived objectivity	Comprehensiveness

Table 7 Heuristics content

Evaluation of source

Five articles incorporated findings that regarded source related attributes. First, Bahry, Masrom & Masrek (2016) defined source credibility by the believability, competency and trustworthiness of the source. They argue that source credibility is evaluated by credentials, quality rating awards, the presence of links to other websites with high credibility and a non- or lesser degree of commerciality. Additionally, they mention reputed credibility as a contributing factor to message persuasiveness. Reputed credibility is defined as the credibility gained by third party endorsement. Reputed credibility can be evaluated by cues regarding awards, authors' qualification, affiliations, official titles, scholarly information and source labels. The authors argue that reputed credibility is almost exclusively reliant on external cues, and thus evaluations of reputed credibility can vary greatly among individuals. As previously mentioned in the content section, Dong (2015) showed in an experiment that source credibility is dependent of the content provided, in which ordinary persons had a higher credibility when giving testimonial information, and lower credibility with informative statements. An inverse trend was seen in experts, which were more credible when giving informative information, and less credible when giving a testimonial. For celebrities, it did not seem to matter if they gave an informative message or testimonial regarding for the reader's knowledge gain. When giving an informative message, celebrities were more persuasive than ordinary persons and less persuasive than experts with respect to knowledge gain. However, celebrities were as persuasive as experts when giving an informative message with respect to behavior change, and celebrities who gave a testimonial statement were less likely to change behavior. Furthermore, Syn & Kim (2013) observed that among young adults, medical/health organizations and professionals were rated the most credible. Friends on the other hand were considered the least credible. While this leads to suggest that expert sources are considered credible, McDonald & Nicholson (2004) observed that FDA produced informational pamphlets regarding dietary supplement use did not lead to a decreased intention to use of dietary supplements. Moreover, the second previously used article of Johnson, Sbaffi & Rowley (2016) showed that in first-year students, source recommendation and brand related attributes (e.g. being a well-known brand) was highly valued in the repertoire. While recommendation related attributes were evenly valued by third year students, brand related attributes were valued to a lesser degree. Table 8 illustrates the found heuristics regarding the source.

Found heuristics regarding source		
Believability	Competency	Trustworthiness
Credentials	Quality rating awards	Links to other websites
Commerciality	Third party endorsement	Qualifications
Affiliations	Titles	Scholarly information
Source labels		

Table 8 Heuristics source

Conclusion: evaluation strategies of dietary supplement users

Regarding the evaluation strategies of dietary supplement users, findings indicate that format is evaluated by for example the degree of aesthetics, commercials and interactive elements. Format is evaluated for two reasons. First, to assess credibility of the platform in general before reading the information to construct an efficient search strategy. Second, to assess credibility of the information itself. The source could be evaluated on the basis of credibility indicators like credentials, organization and commercialism. Furthermore, reputed credibility was also used to assess source credibility, using indicators like third-party endorsement or affiliations. Content could be evaluated using indicators like scientific jargon, consistency, accuracy and referencing. Moreover, the evaluation of source and the evaluation of content seem co-dependent of each other. Discourse can yield different degrees of credibility dependent of the source. In this case, ordinary people were perceived more credible when giving a testimonial message than experts. This phenomenon could possibly be related back to the epistemic struggle referenced by Huovila & Saikkonen (2015). They argue that personal experiences can be appealing, and that experiences would serve as more credible knowledge claims than using population based research. Narratives like these could thus prove more credible than plain informative messages. However, this does not explain why narratives are persuasive when shared by ordinary people but not when shared by experts. Self-relatability between a reader and a source could possible function as a cue for credibility. For example, Moran, Lucas, Everhart, Morgan & Prickett (2016) observed that anecdotal narratives can be persuasive when giving anti-vaccine information in web-based content. Hence it would prove that the evaluation of web-based content is more complex than just the application of indicators or systematic processes, and that feelings and self-relatability play a role within the evaluation of information resources.

In short, with respect to the heuristic-systematic model, findings indicate that the evaluation of information resources follows a predominantly heuristic method, in which cues relatable to format, content and source are used to assess credibility. Not only does this processing mode lead to a more easily evaluation regarding web-based information, it also functions to allow a more economical search strategy. The degree to which the systematic mode is used to evaluate remains unclear in this part of the review. Additionally, it was observed that the evaluation of information resources incorporates more complex evaluation strategies that revolve around self-relatability and sentiments. Moreover, the repertoire that is employed in the evaluation strategy can vary among groups with different educational backgrounds.

This review mainly incorporated studies that employed an experimental design. This supports the validity of the findings, however, whether the same patterns would be seen in a real-life situation is debatable. Moreover, findings from the cross-sectional survey thus leads to speculate whether the given repertoires truly reflect the observed decision making model. These limitations nuance the findings to a certain degree, however, the articles that employed an experimental design were deemed to give a robust theoretical basis in this review. Although these articles predominantly did not target dietary supplement use, they did focus on health-related information. Whether these findings can be directly generalized towards dietary supplement use is unclear, however, the topic of health is in many ways relatable to dietary supplement use.

2.3 Systematic literature conclusion

In this literature review, three topics have been explored. First the characteristics of dietary supplement users were given. Second, the information collection channels and methods were elaborated upon and third, the evaluation strategies of information were discussed. First, concise answers to all three sub questions will be given.

What are characteristics of Dutch dietary supplement users?

Dietary supplement users tend to have a higher socio-economic status. They tend to be older, female and live in an urban environment. Dietary supplement users are more likely to show healthy behaviors like non-smoking, regular exercise and moderate alcohol consumption. Furthermore, they are more likely to show healthy eating habits and to have a low BMI. Dietary supplement users could also have been diagnosed with a chronic condition or show symptoms.

How do Dutch dietary supplement users and non-users collect information about nutrition?

In the general collection of health information, information is collected in both heuristic and systematic ways. The most prominent mode in this collection seems to depend on educational background. To gain confidence in the acquired information, parallel evidence is used to decide on credibility, and formal and informal sources are integrated instead of just being added to each other. Internet, interpersonal contacts and physicians were most used channels for information acquirement. Printed media and television were additional sources.

What evaluation criteria are applied by Dutch dietary supplement users and non-users regarding nutrition communication?

In the general evaluation of health information, and hence in information regarding dietary supplement use, criteria with respect to format, content and source related attributes are used. In format, decision rules regarding aesthetics are used to assess credibility in the search for information and assessment of credibility during information processing. In content and source, decision rules are used to assess expertise when being given an informative message, and probably, decision rules are used to assess whether the content is relatable in case of an testimonial message. Additionally, third party endorsement is seen as a heuristic for credibility, and scientific discourse can boost credibility. Evaluation repertoires can differ, and can possibly be related to educational background.

Visual summary of the systematic literature review

Figure 3 presents a summary of the findings incorporated in the heuristic-systematic model. Systematic processes that were found regard the analytical search strategies and the integration of sources during information collection. Found decision rules are mentioned, which include the use of aesthetics, discourse and parallel evidence finding. Moreover, the used channels for information collection are mentioned and the characteristics of dietary supplement users are shown.

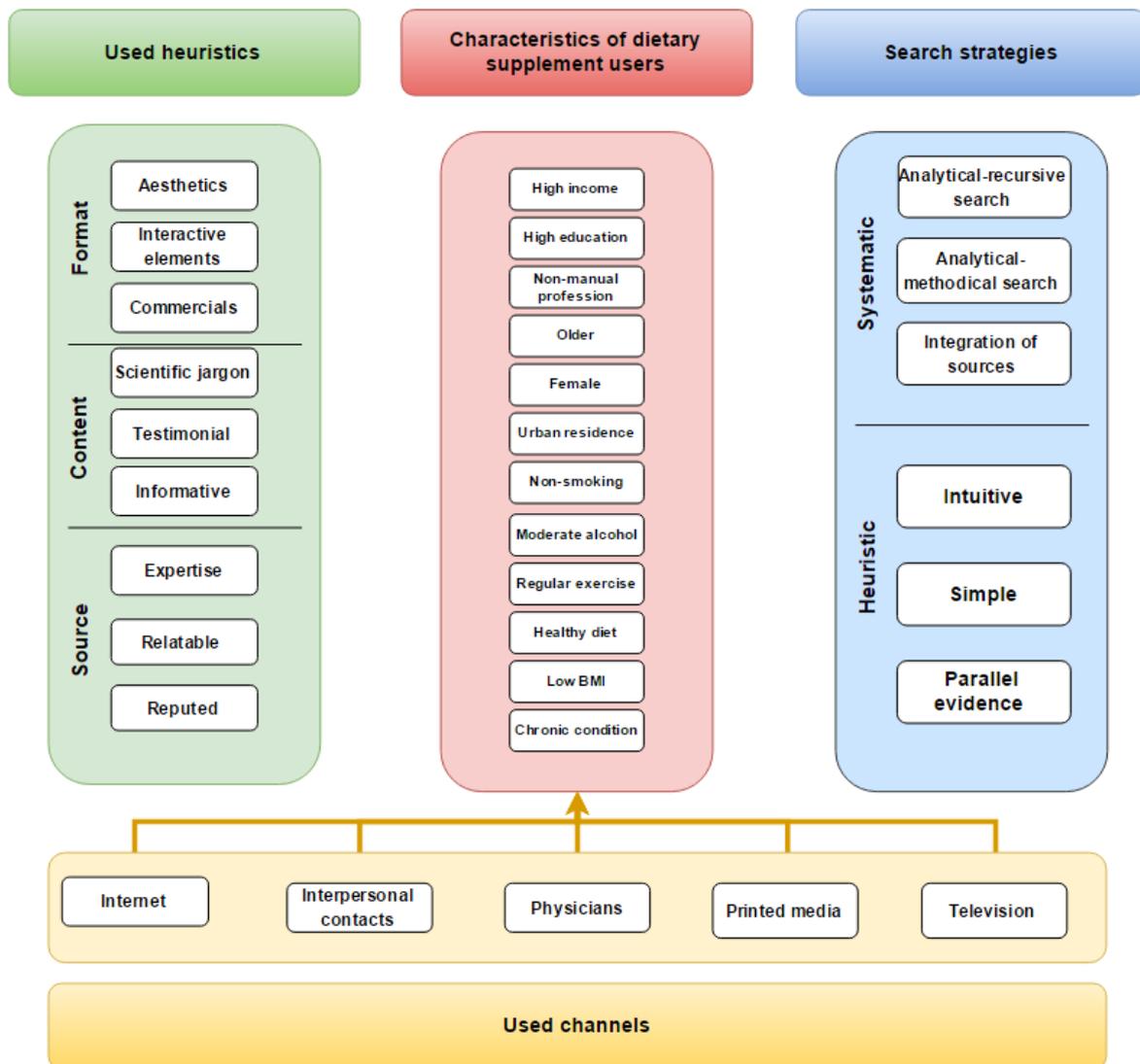


Figure 3 Summary literature study

Discussion

Regarding the evaluation strategies, the literature review shows that health information is evaluated on the basis of format, content and source related variables. Firstly, the observation that content and source credibility are dependent of each other matches with the current academic stance regarding nutrition communication strategies. Moreover, in the review it was not clearly found whether individuals use either heuristic processing or systematic processing. However, in accordance to the heuristic-systematic model, content, source and format related qualities of messages have a lesser effect on systemic processing individuals, who instead assess the message on its argumentation. The same applies in the searching strategies. Dietary supplement users have distinct characteristics from non-users, which might affect their information processing strategy. The involvement in health might indicate a more systematic processing strategy, and might thus prove vital for tailored communication to dietary supplement users.

Chapter 3:

Empirical study

3. Empirical study

Chapter three regards the empirical study. First, In preparation to the field research, an exploratory content analysis on articles regarding antioxidants was carried out for the interview protocol. Secondly, interviews were carried out to collect data for all three the sub questions.

3.1 Exploratory content analysis

3.1.1 Exploratory content analysis methodology

The exploratory content analysis served to construct the interview protocol. To tailor nutrition communication towards dietary supplement users, it is imperative to gain a view of the currently available information. The aim of the exploratory content analysis was to help construct the interview protocol by analyzing the most likely encountered web-based articles within a search for antioxidants. Findings from the exploratory content analysis were used to construct articles which resemble the available articles to the public, and to let users and non-users evaluate these to assess their evaluation methods. To gain this perspective, a sample of web-based articles regarding antioxidants was drawn. Content, format and source of the articles was analyzed. The topic of antioxidants was purposively chosen as the case in the interview protocol because of the many misconceptions that surround antioxidants (Bast & Haenen, 2013). This food component would thus serve as a good topic to assess the evaluation strategies of users and non-users.

First, the search engine 'Google' was used to look up the articles because Google is the most widely used internet search engine (Netmarketshare, n.d.), and would hence give a good perspective in the search results for dietary supplement users and non-users. Second, two search terms were used to look for web-articles about antioxidants. Used search terms were 'Wat zijn antioxidanten' (what are antioxidants) and 'antioxidanten' (antioxidants), which according to google trends (n.d.) were the most used search terms to find information regarding antioxidants in the Netherlands at date of sample selection. Third, for each search term, five web-articles were selected (excluding duplicates). These ten articles in total served for the exploratory content analysis. The rationale behind this sampling strategy is to uncover the expected read articles regarding antioxidants by dietary supplement users or non-users if they were looking for information. The yielded web-articles are shown in table 9.

Nr.	Source	Date	Words
1	Voedingscentrum	n.d.	869
2	Velde, J. van der	2014	1385
3	Gezond Idee	n.d.	759
4	Gezondheidsplein	n.d.	2175
5	Poley, P. (gezondheidsnet)	2009	493
6	Preventievegezondheidszorg	n.d.	1668
7	Fit for me	n.d.	257
8	Fit	2014	927
9	Dubbers, M. (energiekevvrouwenacademie)	n.d.	1329
10	Antioxidant	n.d.	307

Table 9 Sources content

Data-analysis was conducted by open-coding. During the open coding, attention was given to the following:

Content	Source	Format
Knowledge claims	Institution	Advertisements
Populations	Blogger	Images
Dietary supplements	Informative website	Color use
Discourse		Banners
Information topics		Navigation
Health effects		
Advise		
Argumentation		
Persuasive cues		

Table 10 Codes content analysis

For format, after the initial open-coding phase, codes were adjusted, merged or deleted to form categories. These were merged into themes, which will be discussed in the results section.

3.1.2 Exploratory content analysis results

Content related findings will be presented first. Secondly, findings regarding the source will be discussed and thirdly, findings related to the format will be given.

3.1.2.1 Content

Four major themes were identified within web-articles that represent dimensions regarding information about antioxidants. The first theme regards discourse, and deals with the use of words in argumentation and framing. The second theme discusses health related topics. The third theme discusses more specific biochemical processes of antioxidants and free radicals. The fourth theme regards the advice that is given. Table 11 illustrates all the themes with respective categories and codes.

Discourse

Four categories could be distinguished within the theme of discourse. First, argumentative quality was enhanced in different ways in the web-articles. Authors for example used academic literature to strengthen their claims. Furthermore, testimonials and popular literature were used. Most interesting was ascribing the sense of 'natural' to certain concepts. One author recommended against using dietary supplements by stating the following:

"Healthy products are first processed in a factory to the point that they do not contain any healthy antioxidants (or other components for that matter) anymore, and then later, they add them artificially. That is not how nature intended it." – Dubbers, M. (n.d.).

So in general, external sources or explicit opinions were used to convince readers of the proposed claims. Author's also nuanced their claims by stating that more research had to be conducted for claims to become conclusive.

Second, authors employed different ways to give readers a sense of immersion or to give intonation to their story. Rhetorical questions or statements like *"What are antioxidants"* – Fit. (2014) or *"Do antioxidants help against wrinkles"* – GezondIdee (n.d.) were used to immerse readers into the story. One author started the story by explaining the role of oxygen in human life from a historical

perspective. Furthermore, readers were comforted about the given advice by saying that it was 'a good idea'.

Third, colorful wording was used to give direction to certain propositions. For example, military terms were used like 'defensive system' and 'exterminate'. Moreover, certain processes were labeled as 'healing' or 'cleansing'. Value was given to food components using words like 'powerful' or 'bad'. Wording did not confine itself to only give direction, at some points the imperative was used to literally tell what the reader is supposed to do.

Fourth, context was created by illustrating concepts by using imaginary examples. For example, the processes of oxidation was illustrated by using rusting metal or the color change of a cut apple. In some instances, emphasis was laid on individual needs instead of the needs for populations.

In conclusion, within the sample, authors of web-articles supported their argumentative quality by referencing scientific articles, created immersion by e.g. rhetorical questions or the use of historical context. Moreover, colorful wording was used to give direction to certain propositions, and lastly, concepts were illustrated by comparing them to different situations.

Theme	Category	Codes	# codes	# quotations
Discourse	Argumentation	[Explicitly expressing opinion] [Falsifying claims] [Implying the need for more research] [Referencing to popular media] [Studying] [Testimonial] [Use of research] [Using 'natural' as reason] [Using popular literature]	9	76
Discourse	Scene setting	[Asking reader personal questions] [Mentioning good things] [Reminiscence of info] [Saying it's a good idea] [Use of historical context] [Use of irony] [Use of rhetorical statements] [Using rhetorical questions]	8	33
Discourse	Colorful wording	[Attributing 'cleansing' properties] [Discourse] [Hedging] [Labeling oxygen as 'acid'] [Labeling process as 'weird'] [Mentioning 'healing' properties] [Mentioning healthy 'fuel'] [Scare tactics] [Use of casual words] [Use of imagery] [Use of imperative] [Use of military terms]	12	51
Discourse	Creating context	[Attributing value to components] [Focus on individual] [Giving straight advice] [Illustrating nutritional compounds using example] [Illustrating oxidation using example] [Illustration of quantity using time]	6	26
Health	Bodily functions	[Blood pressure] [Brains] [Breathing] [Cell aging] [Cell growth] [Digestion] [Eyes] [Fertility] [Heart rate] [Immune system] [Memory] [Metabolism] [Nerve system]	13	32
Health	Minor health problems	[Age spots] [Dental problems] [Headaches] [Inflammations] [Joints] [Skin] [Tissue damage] [Weight loss]	8	31
Health	Major diseases	[Alzheimer] [Cancer] [Coronary disease] [Diabetes] [Infectious disease] [Metabolic disease] [Strokes]	7	37
Biochemical information	Sources of free radicals	[External sources free radicals] [Internal sources free radicals]	2	18
Biochemical information	Mechanisms of antioxidants	[Antioxidants detoxifying] [Antioxidants protect] [Special functions antioxidants] [Synergy antioxidants]	4	21

Biochemical information	Theory of oxidation	[Free radicals] [ORAC] [Oxidation process] [Oxidative stress]	4	24
Biochemical information	Effects free radicals and antioxidants	[Negative effect antioxidants] [Negative effect free radicals] [Positive effect antioxidants] [Positive effect free radicals]	4	30
Biochemical information	Balance free radicals and antioxidants	[Balance in antioxidant intake] [Overdose antioxidants] [Overdose free radicals] [Oxygen balance]	4	15
Advice	Groups in need of antioxidants	[People suffering from stress] [People with unvaried diets] [Seniors] [Smokers]	4	5
Advice	Behaviors that increase need for antioxidants	[Eating too much] [Flying] [Medicine] [Smoking] [Soda pop] [Stress] [Too much exercise]	7	14
Advice	Strategies to gain health using antioxidants	[Avoiding free radicals] [No supplement use] [Normal diet] [Sources antioxidants] [Superfoods] [Supplement use] [Supplements] [Variation]	8	76

Table 11 Themes of exploratory content analysis

Health

Three categories could be distinguished within the theme of health. Web-based articles frequently pointed out to health effects regarding general bodily functions, minor health problems and major diseases. First, antioxidants were linked to an array of bodily functions including blood pressure, the nerve system, immune system and fertility. Cell growth and the immune system were the two most frequently mentioned bodily functions that were affected by antioxidants. Claims mainly proposed a positive effect of antioxidants on the immune system, and proposed that antioxidants countered uncontrolled cell-growth.

Second, minor health problems were linked to antioxidant intake in the web-articles. Inflammation was the most frequently mentioned health problem, and authors mainly stated that oxidation by free radicals led to inflammations. Other discussed minor health problems included skin related health problems, headaches, weight loss, dental problems, age spots, problems in joints and tissue damage.

Third, web-based articles discussed major diseases that were said to be related to antioxidants and free radicals. Most notably discussed were coronary diseases and cancer. Other linked diseases included diabetes, infectious diseases, metabolic diseases, Alzheimer and strokes. These findings were not representable in all articles within the sample. The 'Gezondheidsplein' article was especially focused on the related health conditions, however, mentions of either bodily functions, minor health problems and major disease were seen across all web-articles.

To conclude, in web-articles regarding antioxidants, antioxidants are frequently linked to bodily functions, minor health problems and major diseases.

Biochemical information

Articles frequently discussed the biochemical processes regarding antioxidants and free radicals. Five categories could be distinguished in this theme. First, articles explained what sources of free radicals are. Most information regarded external sources of free radicals, in which for example smoking, sunlight and oxygen were proposed external sources of free radicals. Diseases and byproducts of the metabolism were mentioned internal sources.

Second, the internal mechanisms of antioxidants were discussed. Topics regarding this category ranged from the combined effects that some antioxidants could have to the detoxifying and protecting effects of antioxidants.

Third, articles discussed the background theory of oxidation and free radicals. Topics involved the way free radicals impact the body, how oxidation comes about and how it can create stress. The ORAC value of certain foods was also discussed. While this topic does not necessarily consider free radicals, it can be considered a theoretical underpinning of the free radical-antioxidant process.

Fourth, articles were generally nuanced about the role of antioxidants and free radicals, in the sense that they were portrayed as both having positive effects and negative effects on health in certain quantities. However, more attention was paid to the positive effects of antioxidants compared to the negative effects. For free radicals, more attention was paid to the negative effects than positive effects. This trend was also observed in the fifth category, which considered a balance between antioxidants and free radicals.

To conclude, authors paid attention to the processes behind antioxidants and free radicals. In general, authors gave nuanced information about positive and negative effects regarding both antioxidants and free radicals. The theoretical content supplied readers with a proper knowledge base regarding the antioxidant-free radical complex, however, content did not go in specific details.

Advice

The last identified theme considered the advice given to readers. Three categories could be distinguished within this theme. First, authors described certain populations that could benefit from a higher antioxidant intake. Individuals who experience a lot of stress, that have unvaried diets, that are older or smoke were told to maintain a higher antioxidant intake.

Second, certain behaviors were said to increase the need for antioxidants. For example, flying was said to increase the need for antioxidants, as did eating too much, medicine use, smoking, drinking soda-pop, stress and too much exercise.

Third, authors advised how to stay healthy regarding the subject of free radicals and antioxidants. This advice mainly meant that readers had to avoid free radicals and to maintain a normal and varied diet. Interestingly, dietary supplements were generally not advised. Some articles plainly mentioned them, and one article suggested it's use. Another frequent mentioned advice was the use of superfoods. Authors frequently listed products that contained high amounts of antioxidants.

To conclude, authors aimed at illustrating groups or behaviors that tend to have a higher need for antioxidants, and advised to increase antioxidant intake through a varied diet and 'superfood' consumption.

3.1.2.2 Source

There was diversity among the sources that supplied information regarding antioxidants. Table 12 presents the sources.

Voedingscentrum	Official food agency
Velde, J. van der	Food blogger
Gezond Idee	Information platform initiated by Maastricht UMC (hospital)
Gezondheidsplein	Information platform initiated by a collective of other platforms that serve to supply health related information
Poley, P. (gezondheidsnet)	Health platform run by various health experts
Preventievegezondheidszorg	Health platform from unknown source
Fit for me	Health platform from unknown source
Fit	Health platform run by students to give trustworthy information about sport and nutrition
Dubbers, M. (energiekevrouwenacademie)	Platform run by a vitality coach
Antioxidant	Platform about antioxidants from unknown source

Table 12 Sources content analysis

The articles were written by bloggers, an official agency, collectives of stakeholders regarding health and medicine and (vitality) coaches. Three sources remained unknown. Not only was there diversity among the sources, but also among the motivations. Some health platforms were initiated by collectives of stakeholders that were professionally involved in health (hospitals, patient's organizations). Some sources were private persons, which could have a different motivation. Most of the sources were professionals with credentials, while others were experience specialists.

3.1.2.3 Format

There were many resemblances regarding format related qualities among the articles. Table 13 presents the formats.

				
1	2	3	4	5
				
6	7	8	9	10

Table 13 Format content analysis

Most articles used imagery to grab the reader's attention and to boost the aesthetics of the article. Most of the images regarded a food product, most of the time with vibrant colors and depicting some fruit or vegetable. Most articles contained some form of advertisement, whether it was for an external company or advertisement of the blogger's own products. Advertisements were mainly at the sides of the internet webpage. All information was divided in paragraphs, and all sites had navigation menus on the side or at the top of the article. The color use was diverse.

3.1.3 Exploratory content analysis conclusion

In conclusion, health, biochemical information and advice regarding antioxidants were reoccurring themes within articles about antioxidants. Colorful wording was used to give direction to the content. Metaphors were used to illustrate the mechanisms of free radicals and antioxidants. Furthermore, rhetorical questions/statements, historical context and imaginary statements were used to immerse readers in the story. To enhance argumentative credibility, authors referenced to academic or popular literature. The articles were from various sources like medical professionals, agencies, bloggers and coaches. The articles had similar elements in the format in which they were presented, which included imagery, advertisements and navigation menus. These findings contributed to the interview protocol in several ways. First, the interview protocol incorporated different texts with different content that regards the evaluation of linked health outcomes with antioxidants. Moreover, the interview protocol incorporated texts in which biochemical information and advice were included. The discourse used in the texts shows variation, and comes from different sources and is presented in different formats. This exploratory content analysis thus aided in the construction of texts that to a certain degree resemble the content that can be found online regarding antioxidants, with variation among the texts to explore how different attributes affect message credibility.

3.2 Field research

3.2.1 Field research methodology

3.2.1.1 Field research aim

The aim of the field research was to gain insight in the evaluation strategies of users and non-users regarding nutrition information, their motivation to use/not use supplements, how they look up this information and to what degree they find this information important.

3.2.1.2 Research design

A (cross-sectional) qualitative research method was employed. The chosen method sufficed in in-depth information. A face-to-face interview was used to obtain the necessary data. This method was chosen to directly observe how users and non-users evaluate nutrition information, and to gain insight in their search strategies and involvement in supplement use and information needs. This method also allowed a think aloud protocol to collect data on the used heuristics. The sample contains two groups. These are dietary supplement users and non-users. The research design is summarized in figure 4.

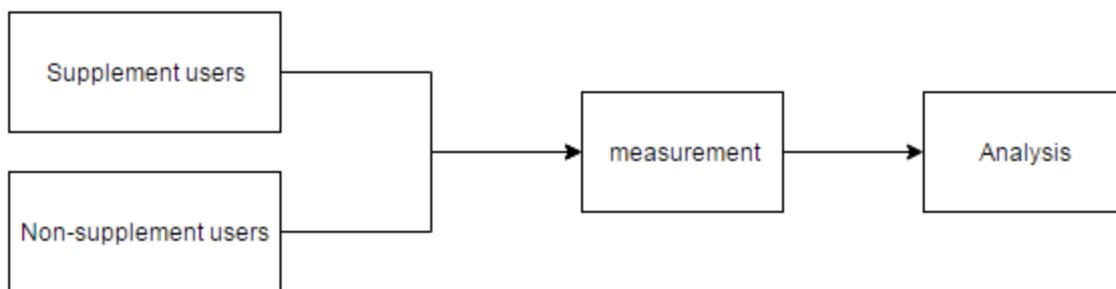


Figure 4 Research design

3.2.1.3 Sampling method

Two groups were recruited to be able to observe whether dietary supplement users evaluated nutrition information differently than non-users. Inclusion criteria were based on the systematic literature review. Common inclusion criteria for both groups were: being female and being higher educated. Additional inclusion criteria for supplement users were: using supplements for reasons other than strict medical reasons, athletic purposes or because of a vegan or vegetarian diet. A convenience- and snowball sampling method was employed to recruit respondents. Flyers were distributed among four dietary supplement retail outlets. An incentive was offered in the form of a voucher for an online shop, which would be raffled among the respondents at the end of the study. Additionally, higher educated women in the researcher's network were approached for an interview, and an add on a local message board was placed.

3.2.1.4 Method: characteristics

To research how individuals are involved in dietary supplement use or non-use and nutrition communication, seven items were asked to dietary supplement users and five items were asked to non-users. For dietary supplement users:

1. *When did you start with using dietary supplements?*
2. *Why did you start using dietary supplements?*
3. *How important are dietary supplements to you?*
4. *What is the benefit you want to achieve by using dietary supplements?*
5. *How important is this benefit to you?*
6. *How do you perceive information about nutrition?*
7. *How much do you like news that regards nutrition?*

And for non-users:

1. *Why don't you use dietary supplements?*
2. *What benefits do you see in not using dietary supplements?*
3. *What drawbacks do you see in dietary supplement use?*
4. *How do you perceive information about nutrition?*
5. *How much do you like news that regards nutrition?*

The first seven and five items for users and non-users respectively served to inquire why users use dietary supplements and non-users do not. Their motivation to use or not-use dietary supplements could imply their level of involvement in nutrition. The last two items for both users and non-users were used to assess their general involvement in nutrition information, and whether they felt that this information would be important to them. The following two working hypotheses are formulated for sub question 1:

H1: Dietary supplement users deem micro nutrients as equally important than non-users.

H2: Dietary supplement users deem nutrition information as equally important than non-users.

3.2.1.5 Method: information acquirement

To compare supplement users' and non-users' methods of acquiring information, five items were used in the structured interview:

1. *What sources do you use to collect information?*
2. *Which sources do you value the most and why?*
3. *Which sources do you value the least and why?*
4. *How much time do you spend on searching information about nutrition/supplements?*
5. *To what do you pay attention when searching for information?*

These five items were used to be able to compare the used sources and channels used by supplement users and non-users, and to assess whether differences between users and non-users might relate to the method of information seeking. The following two working hypotheses have been formulated for sub question three:

H3: Dietary supplement users use and value the same sources for nutrition information than non-users.

H4: Dietary supplement users use the same channels for nutrition information than non-users.

3.2.1.6 Method: evaluation strategies

To analyze the evaluation strategies, respondents were asked to evaluate three texts regarding antioxidants. The three texts are purposively chosen to reflect variation among discourse, source and format in accordance to the exploratory content analysis. The texts are not literal copies from the original internet-based texts. Phrases and paragraphs from the original texts were selected to represent the themes (health, biochemical information and advice) and categories found in the content analysis. First, this creates a roughly equal degree of content among the texts. Second, it ensures that the texts are not too long for the respondent, and as such leads to a decreased concentration of the respondent. Third, adjusting the three texts to be more reflective of the general content on the internet would enhance the external validity and reliability of the findings. The phrases and paragraphs linked to the matching categories and themes can be found in appendix 1. The texts can be found in appendix 2.

Respondents were requested to evaluate the texts by a think aloud protocol. The think aloud protocol entails that respondent make their thoughts verbally explicit while solving a problem. The researcher refrained as much as possible from interruptions or prompts to not disrupt the interviewee's thought process. The advantage of the think aloud protocol regards a lesser recall bias or interviewer bias. Moreover, the think aloud protocol allows respondents to show evaluation strategies that are non-salient. In other words, respondents might employ decision making rules of which they are not aware, and this method might increase their awareness with respect to these rules. Additionally, this method helps in distinguishing systematic processes from heuristic processes. The focus on the actual information provided versus the focus on context might signal the degree of systematic or heuristic processing. Subsequently, a short evaluation took place in which the respondent had to choose the most persuasive text. At the end of this stage, the researcher asked questions regarding the process, to possibly clarify some of the respondent's thoughts. To get the respondent familiar with the think aloud protocol, an initial exercise was performed by the respondent in which differences between two images had to be found while thinking aloud. The following two working hypotheses were formulated for sub question three:

H5: Dietary supplement users employ the same decision rules in the evaluation of nutrition information than non-users.

H6: Dietary supplement users employ the same mode of processing in the evaluation of nutrition information than non-users.

3.2.1.7 Data analysis

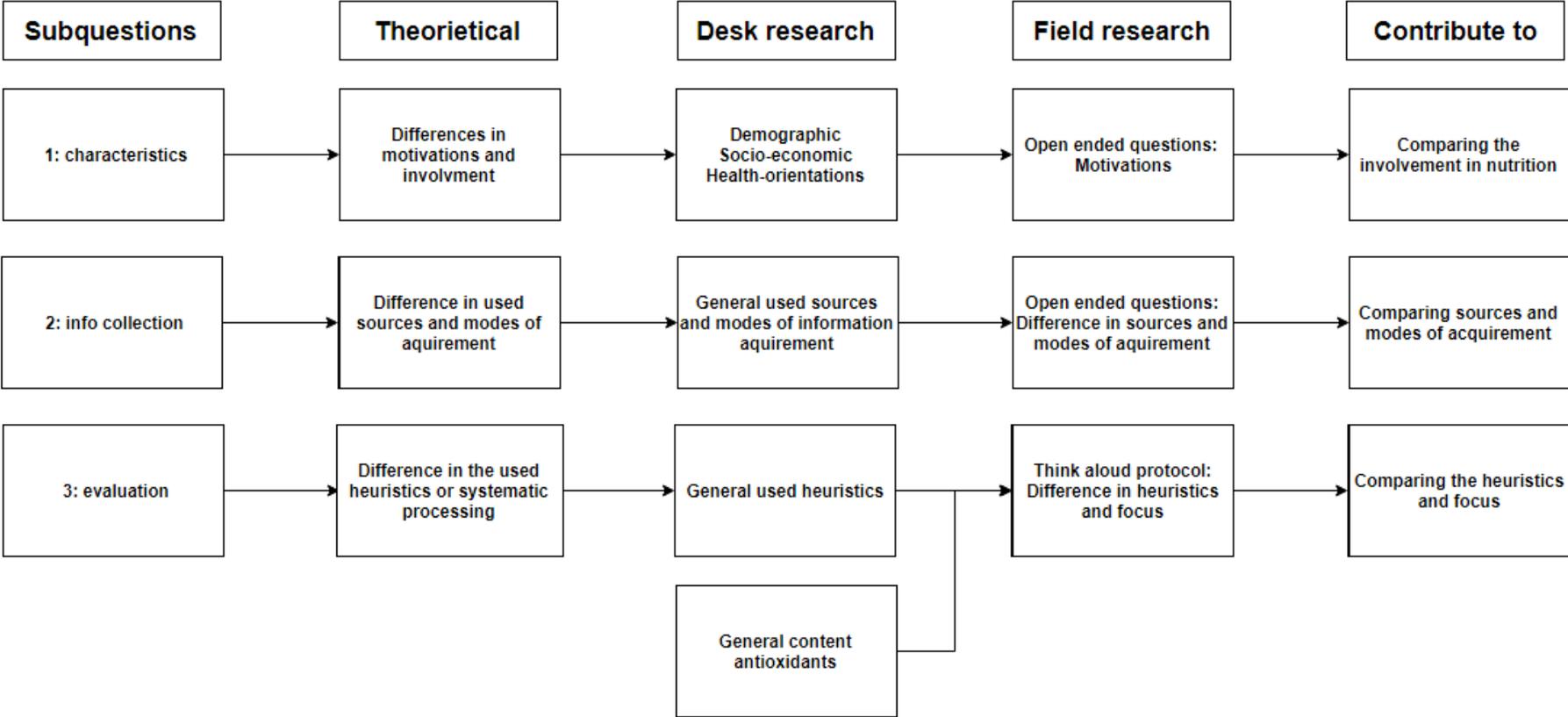
The data analysis consisted out of two parts. First, the data was analyzed to answer sub question one (characteristics) and sub question two (information finding methods). A categorical content analysis was conducted for both sub questions. For sub question one, the motivations for supplement use or non-supplement use was explored. For sub question two, the information collection channels, the views on nutrition communication and the valued sources for nutrition information of both users and non-users was analyzed.

Secondly, to answer sub question three, heuristics that were used during the think aloud protocol and the subsequent evaluation were openly coded. A list of codes regarding the heuristics for both the users and the non-users group was made with the help of Atlas.ti. This list served to interpret the data. Moreover, fragments of the evaluation process that focused on the actual information itself instead of heuristics were coded, and served to interpret whether users and non-users evaluated information on basis of information or whether the evaluated with the help of heuristics. An example of a filled in interview protocol has been included in appendix 6 and an example transcription has been included in appendix 7.

3.2.1.8 Interview protocol construction

The interview protocol (appendix 3) incorporated all three previously discussed items. The protocol was first tested on one volunteer. After this trial, the protocol was adjusted. Ethical approval was granted by the Social Sciences Ethical Committee within the Wageningen University (appendix 4). Respondents had to sign a consent form to be able to participate (appendix 5). Interviews were held at a local library in Nijmegen or at another location of the respondents choosing.

3.2.1.9 Visual summary research design



3.2.2 Field research results

This section will present the results gathered from the empirical research. First, a description of the sample will be given. Second, the motivations for supplement use/non-use will be presented. Third, users' and non-users' views on nutrition communication and search strategies will be presented. Fourth, users' and non-users' evaluation strategies will be presented.

3.2.2.1 Description or research sample

All respondents were female and higher educated. One exception was a respondent who started a higher education program but never finished it. Table 14 presents the respondents' educational backgrounds, profession and supplement use status.

Respondent	Education	Profession	Supplement use
1	Bio-medical science	Studying	(Ex)users
2	Multimedia design	Sales	Non-user
3	Pedagogical science	Education manager	Non-user
4	Communication science	Marketing manager	Non-user
5	Teacher biology/physics	Teacher biology/physics	Non-user
6	Social-pedagogical service	Studying	Non-user
7	College primary education	Primary school teacher	(Ex)user
8	Facility management	Direction secretary	Non-user
9	Surgical assistant education	Surgical assistant	User
10	Hotel management	Marketing manager	Non-user
11	Teacher Dutch/English	Volunteer work	User
12	French literature/kinesiology	Kinesiologist	User

Table 14 Description sample

Users used a diverse set of dietary supplements. User 1 only used vitamin C, while user 7, 9, 11 and 12 used more than one kind of dietary supplement like multivitamins, pro biotics, Vitamine B, D, E and B12, chlorella, fish oil, herbal supplements, and magnesium. Users got their supplements from simple pharmacies (Kruidvat), more modern retail outlets (Vitamin store), a wholesaler or at specialized pharmacies in natural supplements (e.g. De Tuinen).

3.2.2.2 Motivations for use or non-use of dietary supplements

First, user's and non-users' motivations with respect to their (non)supplement use will be presented.

Non-users' motivations to not use supplements

Five categories were identified regarding the non-use of supplements.

1. Supplements are strange

The first category regards the non-users' view that supplements are out of the ordinary or can be regarded as a deviant behavior that is not worth pondering about. First, respondents mentioned that they did not believe in dietary supplements or that they never explored the idea of using them in the

first place. Second, they were sceptic about whether dietary supplements worked, and believed that supplement use was only for those in need of them.

2. Supplements are like drugs

The second category regards the non-users' view that supplements are like drugs. Respondents classified the contents of dietary supplements as 'rubbish' and one respondent assumed that food supplements could have large effects on the body, by which she concluded that the content of dietary supplements must be made of some extraordinary substance. Moreover, non-users' perceived food supplements as being addictive, and that a person is committed to the use of food supplements for his or her entire life. Lastly, respondents valued 'naturalness' over artificial, and said that dietary supplements were not part of a kind of default behavior in their dietary choices.

'There is a lot of junk in food supplements, I think...Because it is such a small pill that delivers a large effect, so there must be something in there... but that is just what I believe,' – respondent 2

3. Yields no extra health

Some non-users did not view dietary supplements as being beneficial to good health. They pointed out that a surplus of vitamins in the body is excreted. Secondly, in contrast to category two, they were critical towards the effects on health one could experience when taking dietary supplements, especially with respect to long term effects. One respondent thought that supplements worked the same way as placebos did. Lastly, respondents mentioned the hazard of taking too many dietary supplements.

'I really wonder if it is just a placebo effect, I wonder what the psychological effect is when you are going to take something that will help you – and that it will make you feel better because of that...but that is just an assumption,' – respondent 3

4. It costs me money

One of the most straightforward reasons for non-users to not use dietary supplements was the issue of money. Non-users mentioned that they did not want to spend money on dietary supplements, something they viewed as frivolous.

5. It influences my proper dietary habits

The last reason why non-users chose to not use dietary supplements was because they thought that dietary supplement use would affect their proper dietary habits. Non-users pointed out that they valued a proper 'normal diet' over the additional use of dietary supplements, and that they feared that if they used dietary supplements, their dietary habits would diminish. Moreover, non-users thought that the use of dietary supplements would interfere with their connection to meals in an emotional way. They pointed out that they value meals as being appetizing and as a moment of bonding with e.g. the family, and that dietary supplements did not belong in that picture.

'You are very aware of what you eat and whether you get enough vitamins and eat according to the [Dutch Food Agency's advice], and if that's the case then I assume that I do not need supplements. An advantage of not using supplements might thus be that you are more aware of your food intake,' - respondent 4

Users' motivations to use supplements

Seven categories were identified regarding the use of dietary supplements.

1. Supplements get me through the rough times

Users pointed out that they used dietary supplements to get them through certain time periods in which they either were more susceptible to disease, like the winter, or in periods in which their diet was not optimal, like when they started studying. Dietary supplement use was thus to support their immune system or to mitigate unhealthy dietary behaviors. Moreover, one respondent mentioned that today's food does not contain enough vitamins and minerals, and thus dietary supplements could help in countering shortages.

2. I got advice from another person

Users were in some cases told that supplement use could help them. One example was a respondent which used dietary supplements because her parents told her to. Two respondents visited a natural healer for advice in the past.

'I came to her because I frequently got a cold and sore throat...and she told me about the side effects of antacids...that they [inhibit] nutrient absorption...which creates shortages, which affects resistance. She invited me over, told me about it and made me enthusiastic about supplements,' – respondent 7

3. Supplements as preventive medicine

Users frequently mentioned that they used supplements for preventive purposes. This could stem from frequently suffering chronic complaints. Secondly, they mentioned that they favored a more natural healing approach than a medical doctor, or that they would try to avoid conventional medicine like antibiotics when possible. Users also mentioned that they used supplements to keep themselves fit.

'I have to say, I am not in favor of antibiotics, so I try to [treat with] food and supplements as much as possible, especially cranberry. I believe that proper nutrition can mean much to the body and towards illnesses,' – respondent 9

4. Supplements give me a safe feeling

Physical health was not the only reason for supplement use. Users frequently pointed out that the use of dietary supplements gave them a feeling of safety and sufficed them in the idea that they put effort in their health, which gave them comfort. Also, users felt that they needed supplements for the previous discussed preventive reasons, which also gave them a sense of safety.

'But it just feels right, it is something [in my mind]. I get up in the morning and the first thing I do is putting some pills in my mouth, shower, and when I am finished with that I will get breakfast, so yeah,' – respondent 9

5. Supplements serve as a buffer

A second reason for supplement use, which relates to the previous category of 'feeling safe', is that supplements serve as an addition for physical health. This includes to counter possible shortages in micronutrients, and as some respondents called it : *creating a 'buffer'* in their nutritional status.

6. More is generally better

Supplement users noted that they felt that it was better to use more supplements than needed than too few supplements.

7. Although, supplements are not my saviors

Users generally saw supplements as an addition. They kept mentioning it as an addition in most cases, and most importantly, they often referred to their own dietary practices as being the main source of good health, which they also paid close attention to. One user was interested in the paleo diet,

another focused on healthy smoothies and healthy eating in general. One respondent mentioned that she would always go to the doctor if things got worse. Moreover, users would mention that they were not addicted, but just were very involved in the use of dietary supplements.

‘That is an attitude a lot of people have. They have an ailment, take a pill and then everything is going to be alright. That ailment stems from something, because your diet is not in order for example, or something is not in order in your life. If you tackle that then you do not need those pills, you need to eat nonetheless,’ – respondent 12

Table 15 summarizes the motivation categories.

Non-users	Users
Supplements are strange	Give me a safe feeling
Supplements are like drugs	Are like preventive medicine
Yields no extra health	More is generally better
Costs me money	Supplements get me through rough times
Influences my proper dietary behavior	I got advice from another person
	They are not my saviors

Table 15 Motivations

3.2.2.3 Search strategies, views and values on nutrition communication

Second, common-, users’ and non-users’ searching strategies, views and values in nutrition communication will be discussed.

Searching strategies

Data regarding the used channels and the used methods for searching information regarding nutrition was collected. First, the used channels will be presented, second, the used methods will be given.

Used channels

Table 16 presents used channels and sources for nutrition information that were common and exclusive for users and non-users of dietary supplements. The channels were either used actively or passively for obtaining information about nutrition.

Non-users	Common	Users
Dietician	Books	Events
News	Facebook	PubMed
Pinterest	Magazines	Instagram
Leaflets at GP	Food agency	Natural expert
Mobile app	Message boards	
	Blogs	
	Acquaintances	
	Google	
	Wikipedia	
	Television	

Table 16 Used channels

One major difference in users and non-users was the use of special events that focused on nutrition and food to collect information. One respondent visited such an event to gain inspiration about diets and recipes. Another difference was the use of a dietician versus the use of a natural expert. While

these two sources are not opposites of each other, they both have different views and methods for giving dietary advice.

Used methods

A common category and an exclusive category for both users and non-users was identified.

Common method: Wherever the wind may take me

Both users and non-users mentioned that they used an intuitive approach when looking up information. This was mainly among non-users, but certain users also used this approach. They would mostly start with google, enter a search term, and just 'click'. They would also find news sites by looking at the references of other sites. One respondent used the Dutch food agency as a starting point, looked at the references and would continue from there. Users more often had a fixed set of sources for looking up information, but when they would look up information on the internet, they would also use an intuitive search strategy.

'Well I go to google – sometimes Facebook – but mostly google...and then I click, start reading, close the window...and I click on a site that speaks to me,' – respondent 4

Non-users' method: It's all for my kids

Non-users admitted that they themselves were not the purpose of their search for information regarding nutrition. Many non-users had children, and they mentioned that these children were there main motivation to look something up on the internet. Additionally, commercial sources were not frequently used for information, because they believed that this information would not be truthful.

Users' method: We keep track of our sources

Users mentioned that they would keep track of sources which they found reliable, and visit these sources more frequently. One user mostly visited bloggers which she found interesting, and would stumble upon these bloggers because they wrote a book she had, or because of their affiliations with other bloggers. Other users used books or professional magazines. Also, users combined different sources in their search for information.

'Then I would try to remember the good sites, or I will make notes or something. Sometimes I make notes and then I search further, when I have found a new search term or something, and then I continue,' - respondent 11

Views on nutrition communication

Common views on nutrition communication

First, common views on nutrition communication will be presented. Three categories were identified that were common between users and non-users of dietary supplements.

1. The information is clouded

Users and non-users mentioned that nutrition communication often shows a lack of scientific support, or that it should show more scientific support than it already does. Moreover, both users and non-users were skeptical towards commercial sources of nutrition information.

2. There is just too much

Users and non-users found that there was just too much available information regarding nutrition. This also regards their observation that every little scientific discovery is fed to the public like tabloid gossip articles. They experienced that messages that zoomed in on one study might depict oversimplified results.

3. Advice should be practical and personal

A common view among users and non-users was that they found that nutrition communication should contain practical information to support healthy diets (e.g. recipes), and that information should be personal relevant. Both users and non-users would be interested in general articles, but only if it posed a personal relevance to them. Both non-users and users, but mostly users, mentioned that they had an interest in information regarding nutrition.

'I would rather look for...I don't know...how I can best store something...or...wait...we ate low-carb for a while...and then I looked for substitution products...something filling...that's what I sometimes look for,'
– respondent 2

Non-users views on nutrition communication

Two categories that were exclusive to non-users were identified:

1. We need the basics

Non-users were not that involved in food hypes and trends, but instead, ought basic nutrition information and guidance to be sufficient in nutrition communication. The thought that the amount of objective information that just explained the basics of good nutrition was too low, and that these basics were most important.

2. We need clarity

Non-users viewed the available nutrition information as confusing. They frequently mentioned that they stood indifferent towards nutrition information. Non-users would often focus on their own feeling when it comes to nutrition instead of looking it up online.

'It's a lot, and there is a lot of commotion about some foods, and later it appears to be oké...they should research it properly first before they bring it to the public,' – respondent 8

Users views on nutrition communication

Two categories that were exclusive to users were identified:

1. The conventional Dutch food agency is sketchy

Two users viewed the Dutch food agency as an unreliable source of information for nutrition. From their point of view, alternative sources, like naturalistic healers, were a more reliable distributor of nutrition information. Skepticism towards the conventional Dutch food agency was due the possible double agenda that the Dutch food agency might have because of to commercial stakeholders.

'That kind of information really depends from the source. I distrust the [Dutch food agency] to a certain degree. They come with advice of which I think...right...how much influence did the food industry have on this?' – respondent 12

2. Nutrition has a big impact on health

A common feature among users was their believe that nutrition could have a large impact on their health. They would mention that they found it interesting how their how their body reacted to a certain new diet or to supplement use. Because of this, users more frequently stated that they would try out new diets they heard off in order to assess the effect.

Table 17 summarizes the common, non-users' and users' values.

Common	Non-users	Users
Information is clouded	We need the basics	Dutch food bureau is sketchy
There is just too much	We need clarity	Nutrition has a big impact
Practical and personal advice		

Table 17 Views

Values in nutrition information

Common values and disvalues in nutrition information

First, common values between users and non-users regrading information sources will be discussed. Three common categories were identified.

1. We value information from both sides

Both users and non-users valued different kinds of information from different sources. Both groups valued information from – from their perspective – experts for technical and objective information. Both groups also saw testimonials from lay-people as valuable when looking for practical information, but not for objective information.

'Depends on how and why you are searching...if I want to know about a specific product then I would go to the product site, but if I have an ailment and do not know what product to use, then I would look on personal blogs,' - respondent 9

2. We do not value commerciality and blogs

Both users and non-users did not value commerciality at all. From their perspective, when a source would try to sell them something, or when they would have the sense a source would try to sell something, the value of the source would plummet. Bloggers were viewed invaluable because of the perceived lack of expertise. This was more prominent in non-users than users.

Non-users' values and disvalues in nutrition information

Three categories were identified regarding the non-users' values in nutrition information:

1. We value adequate information

Users valued sources that used a critical view. A critical view was not necessarily needed, however, when a low credibility source – for whatever reason – shows a critical view, it was more valued. Moreover, non-users more frequently mentioned nuanced information as more valuable. Lastly, they valued sources that used referencing.

2. We value professionals

Users valued professional sources. Professionalism by them were sources that had some classification of authority or qualifications. Moreover, they valued sources who had funding and applied clear research designs in the research of which they communicated their findings.

3. We do not value amateurs

Users did not value of what they saw as unprofessional sources of nutrition information. In their view, sources that were related to media platforms like Facebook were unprofessional. Moreover, they perceived exaggerated claims (e.g. stating that someone's grandma grew one hundred years old because she just ate goji berries – so they must be good) as being typical to amateurs.

Users' values and disvalues in nutrition information

Two categories were identified regarding users' values in nutrition information:

1. We value published material

Users of dietary supplements valued books as an information source. To them, having published something meant that the author must have put a lot of effort in the book, and that this effort stems from a motivation to give correct information. Also, it meant that an editorial office already evaluated the material, and would thus prove more valid.

'Because there is an editorial office behind it, who are critical about who they are letting heard,' – respondent 12

2. We do not value conventional channels

Users did not value conventional channels for nutrition information like the television or newspapers. To them, these sources were biased because they had a commercial purpose, and this commercial purpose resulted in the lower value of these channels for nutrition information. Message boards were not that particularly valued either.

Common	Non-users	Users
Information from both sides	Adequate information	Published material
No commerciality and blogs	Professionals	No conventional channels
	No amateurs	

Table 18 Values

3.2.2.4 Used evaluation strategies

Lastly, the used evaluation strategies of users and non-users will be discussed. First, general observations regarding the evaluation process will be given. Second, content related heuristics will be presented. Third, format related heuristics will be presented and lastly source related heuristics will be given.

General observations

Users evaluated the articles with less heuristics than non-users. Users employed 48 heuristics in total across the three articles, were non-users employed 84. On average, non-users used 12 heuristics while users used 9,6. There were observable differences between the way users and non-users evaluated the articles. Three of the five users tended to examine the actual content of the articles for their evaluation. In this examination, users tried to recall whether or not information provided in the

articles was actually correct. One users did this exclusively, another user admitted that if she really wanted to assess the article, she had to read them again carefully and make notes. Another user found false information in the article. Non-users also tended to analyze information carefully from time to time, but to a lesser degree. On occasions, they would be curious about the actual information provided, and at times signal doubt while reading.

'Then I would need to look it over again, carefully, and make some notes...put everything in order...but I believe the content is somewhat the same,' – respondent 7

'Yeah if you slice an apple...yeah that's true...that's a fact, that's the influence of...yeah that's true...yeah I know oxygen...yeah that's a con for your body...free radicals...let me think,' – respondent 10

'They are light toxic chemicals that react on our DNA and cell walls...we don't have cell walls – we're people. Plants have cell walls,' - respondent 5

Content related heuristics

Three kinds of content related heuristics were identified: 1) heuristics that diminished credibility, 2) heuristics that increased credibility and 3) heuristics that could both increase or diminish credibility.

Decreasing heuristics

Heuristics regarding content that decreased credibility are presented in table 19.

	Non-users (n=7)	%	Users (n=5)	%	Total
<i>Informal writing</i>	6	86%	3	60%	9
<i>No references</i>	5	71%	2	40%	7
<i>Difficult words</i>	3	43%	2	40%	4
<i>No clear message</i>	3	43%	0	0%	3
<i>No nuance</i>	2	29%	2	40%	3
<i>Pushy discourse</i>	1	14%	2	40%	3
<i>Many claims</i>	0	0%	1	20%	1
<i>No support</i>	1	14%	1	20%	1

Table 19 Decreasing heuristics content

Informal writing was a frequently encountered quality that signaled low credibility. Respondents would mention that informal writing signaled low expertise, because expert sources would have used a different writing style. Both users and non-users assessed articles based on this characteristic. The lack of referencing was also a quality that signaled low credibility, although this was more common among non-users than users. The most notable difference was the clearness of the message. Non-users more frequently assessed the credibility as lower because the main point of the message was not clear to them, which was not the case among users. Articles that pushed the reader in an certain opinion (pushy discourse) on the other hand were not favored by users.

Increasing heuristics

Heuristics regarding content that increased credibility are presented in table 20.

	Non-users (n=7)		Users (n=5)		Total
		%		%	
<i>Formal writing</i>	3	43%	1	20%	4
<i>Informative</i>	2	29%	3	60%	4
<i>Matching attitude</i>	3	43%	1	20%	4
<i>Easy to read</i>	2	29%	2	40%	3
<i>Critical view</i>	0	0%	1	20%	1

Table 20 Increasing heuristics content

Formal writing style was used to assess credibility, although this was more prominent among non-users than users. Another notable difference was how informative articles were, in which users were more inclined to assess the credibility as favorably than non-users. Lastly, non-users tended to evaluate the information provided more favorably when it matched their initial attitude towards something, which was less seen in users.

Heuristics that both increase and decrease

Heuristics regarding content that could both increase and decrease credibility are presented in table 21.

	Non-users (n=7)				Users (n=5)				Total
	+		-		+		-		
Decrease or increase									
<i>Natural view author</i>	3	2	43%	29%	1	3	20%	60%	9
<i>Use of analogies</i>	2	2	29%	29%	0	2	0%	40%	4

Table 21 Increasing and decreasing heuristics content

While non-users more frequently assessed an article positively on the basis of a natural view towards nutrition, users more frequently found it unfavorable towards credibility. The same applied towards the use of analogies.

Format related heuristics

Two kinds of heuristics regarding format were identified. First, heuristics that decreased credibility will be discussed. Secondly, heuristics that increase credibility will be discussed.

Decreasing heuristics

Heuristics regarding format that decrease credibility are presented in table 22.

	Non-users (n=7)		Users (n=5)		Total
		%		%	
<i>advertisements</i>	2	29%	3	60%	5
<i>spelling errors</i>	2	29%	0	0%	2
<i>heavy images</i>	1	14%	0	0%	1

Table 22 Decreasing heuristics format

The use of advertisements in articles decreased credibility for both groups. Non-users also assessed credibility on the basis on spelling errors or heavy images (Lies-truth image; *gezondheidsfreaks*), which both diminished credibility.

Increasing heuristics

Heuristics regarding format that increase credibility are presented in table 23.

	Non-users (n=7)	%	Users (n=5)	%	Total
<i>images</i>	1	14%	2	40%	3
<i>aesthetics</i>	0	0%	2	40%	2
<i>font</i>	2	29%	1	20%	2
<i>links</i>	2	29%	0	0%	2

Table 23 Increasing heuristics format

Non-users found that a consistent font and links to other sites increased the credibility. On the other hand, aesthetics and images increased credibility for users.

Source related heuristics

Three kinds of source related heuristics were identified: 1) heuristics that diminished credibility, 2) heuristics that increased credibility and 3) heuristics that could both increase or diminish credibility.

Decreasing heuristics

Heuristics regarding source that decrease credibility are presented in table 24.

	Non-users (n=7)	%	Users (n=5)	%	Total
<i>commerciality</i>	3	43%	2	40%	5
<i>woolly source label</i>	4	57%	0	0%	4
<i>official food agency</i>	1	14%	2	40%	3
<i>no education</i>	1	14%	0	0%	1
<i>weird name</i>	1	14%	0	0%	1

Table 24 Decreasing heuristics source

Commerciality was a quality frequently used by both groups assess the information. The most remarkable difference was the woolly source label (a source label that might indicate a source that is vague and unorthodox, e.g. 'The singing leaf'). Non-users saw this as a source with low credibility. Two users were critical towards the Dutch food agency, stating that they might have a double agenda, and are thus not credible. One user found the same, but only after she read a statement in the article of the food agency in which it explained it was objective.

Increasing heuristics

Heuristics regarding source that increase credibility are presented in table 25.

	Non-users (n=7)	%	Users (n=5)	%	Total
<i>familiarity</i>	5	71%	2	40%	7
<i>Stating objectivity</i>	3	43%	2	40%	5
<i>first hand experience</i>	0	0%	1	20%	1
<i>like-minded</i>	1	14%	0	0%	1
<i>nice logo</i>	1	14%	0	0%	1
<i>written books</i>	1	14%	0	0%	1

Table 25 Increasing heuristics source

A source stating its objectivity was a quality that spoke to both users and non-users. A main difference between non-users and users was the assessment on the basis of familiarity. Non-users tended to assess an article favorably if the source was already familiar to them. In this case, the Dutch food agency was a favorable source. This was less common in users.

Heuristics that both increase and decrease

Heuristics regarding source that could both increase and decrease credibility are presented in table 26.

Decrease or increase	<i>Non-users (n=7)</i>		<i>%</i>		<i>Users (n=5)</i>		<i>%</i>		<i>Total</i>
	+	-	+	-	+	-	+	-	
<i>Personal story</i>	0	5	0%	71%	1	0	20%	0%	6
<i>Lifestyle coach</i>	1	1	14%	14%	0	2	0%	40%	4
<i>Open to change</i>	4	1	57%	14%	1	0	20%	0%	6

Table 26 Decreasing and increasing heuristics source

Users and non-users were different with respect to their view on personal stories in articles. Non-users did not found them supporting credibility, while users tended to not give about them one way or the other. Moreover, non-users found that sources that stated that they were open to change and different opinions were more credible, while again, users tended to not pay attention to these characteristics. Being a lifestyle coach surprisingly was not favored by users.

3.2.2.5 Summary findings

In summary, dietary supplements users showed differences compared to non-users with respect to their attitude towards dietary supplements. Users saw dietary supplements as functional additions towards their diet because of circumstances during their live-course or their higher involvement in their health and dietary practices. Non-users saw dietary supplements as not-functional due a more care-free orientation towards health. Search strategies differed between users and non-users. While non-users used rather standard channels such as a dietician or leaflets from official agencies, users employed more unconventional channels such as events, natural healers and more frequently used books. Non-users viewed that the basics in nutrition information were more important instead of food hypes and special diets, while non-users were sceptic about the Dutch food agency and found information regarding new diets more interesting. Non-users put more value in scientific substantiated material and disvalued amateurs that write blogs, while users valued published material like books and disvalued conventional channels. Users differed to non-users with respect to their evaluation strategies. Users tended to more frequently focus on the actual information within the articles, while non-users evaluated the articles more frequently on the basis of heuristics. Non-users mostly relied on qualities like referencing, writing style, familiarity and source labels to evaluate the articles. Additionally, a natural view, use of analogies and a source who is open to change where favorable qualities and an personal story was unfavorable. This in contrast to users, who found a natural view and the use of analogies as unfavorable, did not quit care about writing style nor for a source who is open to change. Instead, they used qualities like a pushy discourse and how informative the article was as cues for credibility.

Chapter 4: Conclusion and discussion

4. Conclusion and discussion

4.1 Conclusion

In this study, an answer to the research question: *'how do users and non-users of dietary supplements evaluate nutrition communication?'* has been reached. Users evaluate and look for nutrition communication in a different and more elaborative way than non-users due to a higher involvement in their health and nutrition. This first brings us at sub question one: *'What are characteristics of Dutch dietary supplement users?'*, by which in the literature review it was concluded that users had a higher socio-economic status, more healthy behaviors and had chronic complaints. These characteristics were also observed in the empiric study through the motivations of dietary supplement users to use supplements. In contrast, non-users found their health as something as being self-evident and found dietary supplements strange. As a result they did not use dietary supplements. Regarding sub question two: *'How do Dutch dietary supplement users and non-users collect information about nutrition?'*, it can be concluded that supplement users looked for and valued unconventional sources of nutrition information (bloggers, natural healers, published material) to a greater degree than non-users, who used more conventional sources (dietitians, leaflets). Lastly, regarding sub question three: *'What evaluation criteria are applied by Dutch dietary supplement users and non-users regarding nutrition communication?'*, it can be concluded that users were more focused on both the content of the messages and the presented arguments and used less heuristics than non-users. Users and non-users employed different heuristics and also used the same heuristics differently. This for example was the case with the natural stance and the use of analogies, which had opposite effects on message credibility among users and non-users.

The working hypothesis *'Dietary supplement users evaluate nutrition information the same as non-users'* can – although this is an exploratory and qualitative study – be regarded as falsified. From the interviews, it could be implied that users found micronutrients more important than non-users (H1) – as could be seen by their attitude towards nutrition as being a form of medicine or preventive measure. It could not be implied whether users found nutrition communication more important (H2). There were differences regarding the valued sources between users and non-users (H3) and used channels (H4). Dietary users also showed differences with respect to the used heuristics compared to non-users (H5) and ultimately focused more on the information in the articles than contextual features regarding source, format and content (H6).

In conclusion, users of dietary supplements are strongly involved in their health and nutritional status, which can be linked to their information searching methods (conventional versus unconventional) and their more systematic information evaluation strategies (focus on content and the use of heuristics). While the scientific community might uphold a traditional view on nutrition advice – and in that sense believes that everyone that dietary supplement users are somehow confused – in this study, findings indicate that they might be strongly involved in nutrition, and thus look at the traditional advice more critically, which results in the adaptation of more unconventional sources of nutrition information.

4.2 Discussion

The problem statement in this study regards the prevalent confusion among consumers partly due to the diversity of nutrition information that is available for consumers, either through policy-led communication or information that is available on the ‘blogosphere’. Irresponsible dietary supplement use due to the consumption of too high quantities, neglecting healthy behaviors or because of unnecessary use is an issue that can be promoted by nutrition information that steers towards this dietary supplement usage. Therefore, this study aimed to contribute towards tailored communication to dietary supplement users with respect to safe dietary supplement use. Findings regarding the three research questions will be discussed. First, the characteristics and attitudes of users and non-users will be discussed. Secondly, the information collection methods will be discussed and third, the evaluation strategies of users and non-users will be discussed. Lastly, the research design and methods will be discussed.

4.2.1 Characteristics

Findings showed that dietary supplement users had a higher involvement in nutrition and health than non-users, by which it could be implied that users show a higher self-efficacy. A study by Swan, Bouwman, Hiddink, Aarts & Koelen (2015) showed that self-efficacy and flexible restraint were predictors to healthy eating. Being partnered, female and a high sense of coherence were contributing as well. In the same fashion, these predictors to healthy eating might also be a predictor for supplement use. These findings match with the overall conclusion from the literature review in which females and individuals that showed healthy behaviors were more likely to use supplements, on the exception of being married, which did not show a clear link with supplement use. While proper dietary choices do not necessarily include dietary supplement use, this was the case in users, and there were events within their life-course that could explain both their use of supplements and their dietary orientation. Suffering chronic complaints was one of these factors. Within the user group, three users admitted that they would suffer chronic complaints from time to time, and either started supplements out of own curiosity or because they got advice from an expert. Other users stated that they started to use supplements in the past to mitigate unhealthy behaviors, and to create a ‘buffer’ – as they said themselves – against ill-health. Conner, Kirk, Cade & Barrett (2001) observed the same motivations for dietary supplement use among women and found that health values, the susceptibility to disease and the creation of an insurance against ill-health were motivations to start using dietary supplements. Nichter & Thompson (2006) identified the motivation of self-treatment for disease among dietary supplement users. An additional motivation was to regain control in an otherwise unhealthy environment. These motivations stand in line with the findings of the empirical study, in which users tried to avoid conventional medicine or stated that they would use supplements because of the lack of micronutrients in today’s foods. While users’ motivations appear to have a logical source, they also form a paradox. Kirk, Cade, Barret & Conner (1998) observed that women who used dietary supplements show healthy behaviors. They concluded that the use of dietary supplements is part of a healthy lifestyle, and that the dietary supplement users actually are a group that is the least in need of them. Users already show healthy behaviors, which includes a more healthy diet, regular exercise, not smoking and a mediocre alcohol intake. This was in general also the case in the empirical study. So why is it that individuals who already have this healthy mindset and behaviors believe that they are in need of dietary supplements? This paradox is called the inverse supplement hypothesis. The adoption of healthy lifestyles might stem from the previous mentioned motivations from the empiric study, like having chronic complaints, controlling a more unhealthy environment, adopting healthier lifestyles after a period of unhealthy lifestyles or trying to avoid conventional medicine. Dietary supplement use could be adopted as a part of these healthier lifestyles. It thus would appear that dietary supplement users have a greater motivation to manage their health than non-users due to events within their life-course, and are more involved in their healthy lifestyles than non-users. While this can be applauded, too much involvement in nutrition and supplements can be hazardous. A too high involvement in

supplements can be related to orthorexia. Possible parallels between dietary supplement use and orthorexia are: 1) a desire to maximize one's health; 2) unrealistic or magical beliefs about nutrition; 3) use of traditional or nontraditional health care services; 4) turning towards compensatory dietary management when becoming dissatisfied with traditional medications (Koven & Abry, 2015). While there might be commonalities between the practice of supplement use and orthorexia, in no way do they represent the same concept. However, dietary supplement use could be a part of orthorexia due to the fascination and involvement in food. It is for this reason that the effect of nutrition on health remains a delicate topic in nutrition communication. On one side, a high involvement could be applauded. On the other side, it can turn into an obsession. Communication regarding dietary supplements should take this into account.

4.2.2 Search strategies

Differences in search strategies between users and non-users were found. Dutta-Bergman (2009) found that health-conscious individuals frequently use active channels (internet, literature, acquaintances) while health-unconscious individuals tended to use passive channels (television, news). In this sense, both users and non-users would have an information acquisition method typical to health-conscious individuals, however, their strategies are different. A possible explanation comes from the work of Worsley, (2003) who showed that different personal values affect searching strategies. Individuals that valued naturalness valued unconventional sources like alternative health practitioners, while individuals who valued enjoyment, health and security – which revolved around conformity – valued conventional sources. These findings partly relate to the findings of the empirical study. Non-users valued information from professionals, while some users disvalued the traditional Dutch food agency and valued published material from diverse sources. It would be possible that users value more alternative sources through their personal values for naturalness, and non-users value conventional sources through their values for security. Although this last finding might be controversial, because in the evaluation of the articles users stated that authors with a more 'natural view' were less credible. However, this might be because users made less use of heuristics, which will be discussed later. Moreover, both users and non-users valued information with both an informative character and personal experiences from lay-people. This stands in line with the findings of the literature review in which different kinds of messages were evaluated positively when given by different kinds of sources. The empirical study did not identify different degrees of heuristic or systematic search processes regarding searching strategies, which could be attributable to the fact that all respondents enjoyed a higher education, which in the literature review was found to be a predictor of systematic searching behavior. The empirical study did not measure nutrition literacy, however users were more inclined to look up information than non-users. Thus, in relation to the users' motivations to stay healthy, they are also very eager to get information regarding nutrition and are probably more informed about nutrition.

4.2.3 Evaluation strategies

Surprisingly, format related heuristics played a small role in the evaluation process for both groups. This could be due to the fact that the information was not actively searched for, but was presented to the respondents. The different orientations of users and non-users and the heuristics they applied imply a difference in attitude towards nutrition and dietary supplements. According to the heuristic-systematic model, whenever an individual is high involved in a certain topic, a systematic processing of information will occur. The systematic processing in this case shows itself by the employment of content related heuristics by users and their tendency to judge the articles on the basis of the actual information. It is possible that this information processing route is invoked by the previously discussed involvement of users in nutrition and health. Like discussed earlier, users tended to have ailments or struggles with proper nutrition habits in the past. It could be possible that these events and acquired motivations to get more involved in their diet triggers systematic processing. Most respondents stated

that they liked looking up information about nutrition, because it was their job, their hobby or because they did it in the past. Knowledge about the subject allows systematic processing, and in this sense it was the users who had an advantage over non-users. One non-user, who had a background in biology, was also able to assess the information provided in the articles, but at the same time applied heuristics to judge the articles on context.

4.2.4 Limitations

Although a promising conclusion was reached, this study had limitations. First, the sampling method could have resulted in a biased sample. The snowball-sampling method could have impacted the results. A large part of the non-users were from roughly the same age group, had children and lived in the same town. Moreover, no balance between the amount of users and non-users within the sample was reached. Findings regarding dietary supplement users are therefore based on a smaller sample, and could be regarded as less reliable. The exploratory content analysis had limitations as well. The exploratory content analysis was carried out using a systematic approach to select the articles that were included in the analysis. While the analysis included the most probable found articles regarding antioxidants, it surpassed the available information that could be found in published material or sources of information from audio-visual sources.

By the heuristic-systematic model of information processing, this study took a deductive approach, beginning with the general hypothesis that users evaluate information the same way than non-users, and testing this hypothesis by collecting data on involvement in health, involvement in nutrition information, used heuristics and focus on content in the evaluation process. First, the use of qualitative methods could be regarded as unorthodox with respect to the heuristic-systematic model, which predominately is used in experimental settings and not so much in exploratory research. So whether the chosen method would prove constructively valid is unsure. Due to the use of this model and the deductive approach, aspects that would determine the differences in the evaluation process may be left out, which otherwise could have served in the construction of communication tailored towards dietary supplement users regarding risks and necessity. An inductive approach might also have been more suitable with e.g. the life-course perspective or the salutogenic framework, in which the focus would lay on past experiences relating to supplements, nutrition and health within users' and non-users' life course and what it meant for them with respect to nutrition communication. While this framework would have resulted in many probable determinants that affect the evaluation of nutrition communication, it would not have delivered results that would directly contribute towards tailored nutrition communication.

The major strength of this study was the think aloud protocol. As previously stated, it diminishes recall bias in the interview with respect to evaluation strategies. Moreover, it grasps a wider context of information evaluation than experiments or quasi-experiments, methods frequently used to research information evaluation and persuasiveness. While experimental designs can be used to analyze casual variables, the evaluation of information is always context dependent. In this study, this context was analyzed, and can contribute towards the creation of target-group tailored nutrition communication towards dietary supplement users regarding risks and necessity of supplements. Additionally, due to the buildup of the research protocol, it was made clear that dietary supplement users are involved in their health and thereby stand more critical towards information. This study did not only answer the 'how' question, but also a 'why' question, which allows nutrition communicators to specify the content of the messages towards dietary supplement users. Strong involvement is normally something that should be applauded by nutrition and communication scientist, because it would lead to stronger attitudes because of systematic processing. This study depicted how strong involvement in nutrition leads to the evaluation of information in a wider context, which could also be used in different segments within society.

5.0

Recommendations

5. Recommendations for tailored communication

This section will present the recommendations for tailored communication towards dietary supplement users regarding risks and necessity for supplement uses. Recommendations derived from the literature review and empiric study. First, academic recommendations will be given. Second, applied recommendations will be elaborated upon.

5.1 Academic recommendations

The area of communication sciences could greatly benefit from further exploration of the dynamic context that constitutes message persuasiveness. First, in line with H1, studies should examine the reasons why nutrition and micro nutrients become more important to some people than to others. These determinants might help to create involvement in nutrition among other population segments. Second, in line with H2, research should focus on how consumers can be made more aware and involved in nutrition information. The previous discussed backlash beliefs pose a threat to nutrition communication, so this research should focus on how to overcome these backlash beliefs. Third, in relation to H3 and H4, findings indicated that different segments in society value different sources and channels for nutrition information. Future research should focus on uncovering how these channels and sources could be used to benefit nutrition communication. Fourth, in relation to H5 and H6, future research should also aim at uncovering the links between message credibility factors and what factors are important in what segments regarding nutrition communication. Knowing what factors contribute to credibility in different segments in society allows tailored nutrition communication towards these segments.

With respect to dietary supplement use, further research should aim on exploring the nutrition literacy of dietary supplement users and the awareness of risks regarding dietary supplements. This study confirmed that dietary supplement users are involved in nutrition, but it did not aim to assess objective knowledge regarding the subject. Users motivations and auto-didactic behavior could be applauded, but whether the information sources they employ are valid and whether they are reliable remains unclear. High involvement and systematic processing generally leads to strong attitudes. The risk thus lies in the possible untrue information and advice that is available in the 'blogosphere'. In this sense, users can be very motivated, but can have non-expert based knowledge about dietary supplements.

5.2 Applied recommendations

For tailored nutrition communication to dietary supplement users regarding risks and the necessity, the following recommendations can be given:

1. Channel : Communicate information through events, magazines or other literature

While communication through the internet or social media may prove the easiest way to reach masses of people, it is certainly not the most credible way. Users got their information mainly from unconventional sources. Risk communication regarding dietary supplements should be done via special events or articles in particular magazines. Natural healers are another source that could be employed, however, it could be possible that these specialists are already informing users about the risks – as did a natural healer who participated in this study. If this would not be the case, push strategies towards users via natural healers and dietary supplement retailers could also be a way to inform about the risks.

2. Source: Make it more personal

While users did not focus that much on source related cues for credibility, a personal story was one of the message qualities that could boost the credibility. So regarding source related characteristics, an individual that has no relation to professional agencies (e.g. the Dutch food agency) might be received as a more credible source for dietary supplement users. Additionally, a non-commercial source is more believable. This recommendation stands in line with the recommendation regarding the used channels. The issue with the Dutch food agency stems from the skepticism the users have. As a source, there is not much the agency could do about this, even if the agency states that it is financed by the government only.

3. Content: Concise and practical information which leaves room for interpretation

To inform dietary supplement users about possible risks regarding dietary supplements, concise information should be given. The information should mainly contain a summation of the risks, references for this information and should be supported by an elaboration upon the statistical findings in studies. Displaying info in this fashion would match the systematic evaluation strategies which are employed by dietary supplement users. Do not use woolly language, but be direct. Moreover, the tone of voice should be formal. The information should not be steering, but should leave room for an open interpretation, this in contrast to the generic recommendations towards nutrition communication. Also, the key to good nutrition communication is that it can be applied in practice and that it is rewarded with good-health. Both users and non-users valued practical information. So a good start would be to advise users on which products they could use that contain a high dose of micronutrients instead of dietary supplements. Regarding the actual content of the information, two elements are suggested that would nuance the attitude towards users regarding dietary supplements:

A. Proposition: health is more than nutrition

While the involvement in nutrition should be applauded, it can certainly have its drawbacks. Supplement users should be made aware that health is more complex than just the input of micronutrients which delivers an output of good-health. The excessive usage of dietary supplements can be countered by making people aware that health is a complex issue, which is not created by just the usage of pills nor just nutrition.

B. Proposition: supplements are not magic

Related to previous recommendation, it should be communicated towards users that supplements indeed can support the health and the immune system, but do not function as a magic shield or remedy against disease. This proposition might nuance the attitude that more supplements are always better than one to few. This might prove a very difficult message to pass on – due to possible strong attitudes of dietary supplement users. Therefore, this message should be conveyed on a previously discussed informative way. It remains important to leave the message open for the interpretation of the reader, so narratives could be possibly used to convey this and the previous message.

4. Format: less is more

Findings from the literature review indicated that format was important in the search for information, however format related heuristics were not commonly used among both users and non-users. This may have had to do with the fact that the articles were merely presented to the respondents, and they themselves were not actively looking for information. The recommendation is to pay attention to a pleasing format which is also easy to navigate to increase the odds that the information is read when stumbled upon, and that no advertisements should be placed in the format to avoid a commercial impression. In general, not that much attention should be paid to format, while it may distract from the actual content that is important to dietary supplement users.

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