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Information needs on nutrition in link to cancer prevention among cancer patients, high-risk individuals and general population - A national cross-sectional study

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s u m m a r y

Background & aims:

Nutrition is one of the fundamentals of cancer prevention. Knowing what are the patients' needs and beliefs in terms of "nutrition and cancer" information helps tailor future nutritional interventions. The aim of this study was to evaluate specific information needs about "nutrition in relation to cancer prevention", including primary and tertiary prevention, among cancer patients, cancer free individuals, and genetic high cancer risk individuals.

Methods:

This online survey was shared within two large National cancer social networks and proposed to all attendees and carers of a comprehensive cancer center.

Results:

2887 individuals answered the survey (of whom 33% were cancer patients, 13% high-risk individuals and 55% participants of the general population). More than 80% of participants were women, had at least a high school degree. Median body mass index was 23.2 kg/m². Eleven percent (n = 321) were following a diet, mostly low carbohydrate and weight-loss diets. Around 70% of all categories felt they lacked information on nutrition and cancer interplays. Only 12% of cancer patients (n = 108) considered they had received enough information on nutrition during their care pathway. A majority of participants agreed that food can modify cancer risk (93%, n = 2526) and 66% (n = 1781) considered that nutrition should be personalized according to the risk of cancer. Only twenty-nine percent (n = 792) believed that eating 5 fruits and vegetables a day was enough to avoid cancer, but 64% (n = 1720) thought that dietary supplements could help obtain a better health. All proposed nutrition topics were considered important by the participants.

Conclusions:

Although cancer patients and cancer-free respondents, whether at high risk of cancer or not, share a common broad interest on the interplay between nutrition and cancer and seek after more information on this topic, some false beliefs are observed. Healthcare providers could successfully propose more evidence-based information to these populations.

1. Introduction

The impact of lifestyle and especially of nutritional factors on the risk of cancer is a topic of growing interest for the general public, in parallel of massive scientific knowledge development on the causal or favouring role of nutritional habits on the growing incidence of cancers worldwide [1,2]. Diet and nutritional modifications could potentially prevent or delay several cancers, through several cross-linked mechanisms including weight control, avoidance of the cancer-promoting and immune-suppressive effects of inflammatory diets or toxic exposures, promotion of the microbiome's equilibrium, etc. [3,4]. Around 56% of all cancers

and cancer deaths and disability-adjusted life-years lost are attributable to an dietary factors, independently of overweight and obesity [5e7]. A “healthy lifestyle” includes regular physical activity together with weight control; a high proportion of foods of plant origin; limitation of calorie intake, alcoholic drinks, red and processed meat, ultraprocessed food, salt and dietary supplements; and avoiding smoking [8,9]. Such a lifestyle has been broadly associated with a gradually decreased risk of multiple cancers including colorectal and breast, even among high-risk individuals such as BRCA1/2 or Lynch syndrome mutation carriers [10e12]. Beyond primary prevention, dietary factors also affect many outcomes of cancer patients at all phases. A healthy lifestyle and dietary habits could moderately reduce the risk of cancer recurrence and mortality after breast and colon cancer [13,14] and all-cancer mortality [15]. New insights into the effects of specific dietary components have recently improved our comprehension of the complex role of dietary and nutritional patterns at these different steps [16e19].

Social aspects have a great role to play, not only because nutrition is strongly socially determined, but also in view of the major marketing pressure in this field. Sources of information and knowledge allowing individual choices are a key component of patients’ choices, although they are also largely driven by emotional aspects, including values, beliefs, etc. [20]. Beliefs are however often influenced by fake news regarding the “miraculous” potentials of certain food or diets to protect against cancer or cancer relapse, often driven by commercial interests [21].

Having reliable sources of information can theoretically, not only allow patients together with healthcare professionals to make better cognitive choices, but also to be less influenced by commercial or other non-scientific biased information. Information on nutrition is critically important to support individuals in making better healthcare decisions along the continuum of care [1,22]. Various surveys showed that cancer patients are concerned about nutrition, mainly during and after cancer treatments, but only few perceive that they have received sufficient information and support from health care professionals for this matter [23,24]. A recent survey in the United states showed that less than 50% of cancer patients as well as persons from the general population received health behaviour recommendations from their physicians, although they had poor nutritional habits [25]. Furthermore, diet and nutrition is a moving target, that is highly influenced not only by a country's culture, but also by social media and companies social marketing at any time [26]. Although major efforts have been made towards including nutrition care as part of the pathway of patients with cancer, little is yet provided to individuals at high risk [27]. In order to build and deliver adequate education and information to patients at risk of cancer, we need more information on their current perception on the information they received previously, but also on their beliefs, needs and wishes on the matter.

Thus, our study aimed to evaluate more in detail specific information needs about “nutrition in relation to cancer prevention” among individuals at high risk of cancer, and compare it to that of persons of the general population or cancer patients. This could help to further tailor adapted nutritional information and interventions at each step of cancer prevention.

2. Material and methods

2.1. Study design

This national cross-sectional survey was conducted using a newly developed, dedicated, online-administered questionnaire mostly based on closed questions. The survey was designed to be self-administered. In the absence of reference, validated, such questionnaires in the literature, the questions were inspired by previous publications in the field [24,28]. After formulating the survey, it was circulated through a panel composed of nutrition, supportive care, epidemiology, and oncology experts, cancer survivors, Gustave Roussy's patients committee, a National patient association (Patients en Réseau) and a cancer fundraising association, Odyssea, for suggestions and modified accordingly until consensus. It was then tested by a small number of patients' representatives to confirm readability. The final survey is included as supplementary information to this paper.

2.2. Study population selection

The questionnaire was open to any adult person volunteering for it and able to fill in the online questionnaire. There were no restrictions. Participants were self-selected and self-declared as belonging to one of three categories: (1) patients with a recent or former diagnosis of cancer, (2) individuals identified as being at high risk of breast and ovarian, or colorectal, or another cancer, (3) non-cancer and non-high risk persons from the general population, including participants who did not know if they were or not at high risk of cancer. For cancer patients, we did not collect detailed information on cancer type, diagnosis date, or type of treatments received. Proposal to participate to the survey was distributed nationally through the social network of two associations: Patients en Réseau (a cancer patients associations dedicated to breast, lung and gynaecologic cancers) and Odyssea, a fundraising association, who has a large general public audience (N = 9000 followers). In order to enrich cancer patients and high risk individuals' representation, it was also proposed to patients and their relatives attending Gustave Roussy during the same period, through posters. Finally, it was also proposed concomitantly to patients at high genetic risk of breast or colorectal cancer who recently attended the genetic clinic, through personal emailing.

2.3. Study questionnaire

The questionnaire (available in the supplementary data) consisted of 30 questions about participants abbreviated demographic data, dietary habits, beliefs and knowledge on the subject "nutrition in relation to cancer prevention" (including primary and tertiary prevention) (such as: "I think nutrition can modify the risks of developing a cancer" or "Some food or vitamin supplements can help me get better") and the importance of various topics within this field (for example: "foods that protect against cancer", "foods that increase the risk of cancer", "organic food", "specific diets and cancer risk", etc). Whenever possible, the proposed answers followed a 7-point Likert scale, as previously described [29] (proposing answers that went from "totally false", "false", "somewhat false", "no opinion", "somewhat true", "true", to "very true" or from "not at all important" to "very important" or "not at all favorable" to "very favorable"). Some questions allowed multiple-choice answers. The full questionnaire was designed to be self-administrated by participants. Most questions were fully structured but comments were possible in certain dedicated zones.

Table 1
Characteristics of participants.

	Total	Cancer patients	Cancer-free participants		
			Total	High risk population	General population
Participants	2887	918 (31.8%)	1969	374 (13.0%)	1595 (55.2%)
Sex					
Female	87.2% (2517)	91.2% (837)	85.3% (1680)	92.2% (345)	83.7% (1335)
Male	12.8% (370)	8.8% (81)	14.7% (289)	7.8% (29)	16.3% (260)
Age (years)					
18 to 29	6.3% (182)	1.9% (18)	8.3% (164)	7.2% (27)	8.6% (137)
30 to 39	13.9% (402)	7.9% (73)	16.7% (329)	15.5% (58)	17.0% (271)
40 to 49	27.2% (786)	23.6% (217)	28.9% (569)	30.5% (114)	28.5% (455)
50 to 59	31.0% (895)	36.8% (338)	28.2% (557)	31.8% (119)	27.4% (438)
60 to 69	16.6% (480)	21.3% (196)	14.4% (284)	11.8% (44)	15.1% (240)
70 and more	4.9% (142)	8.3% (76)	3.3% (66)	3.2% (12)	3.4% (54)
Familial situation					
Single		30.1% (276)	33.4% (657)	33.9% (127)	33.2% (530)
In a relationship		69.9% (642)	66.6% (1312)	66.1% (247)	66.8% (1065)
Education background					
<High school degree	11.7% (338)	18.5% (170)	8.5% (168)	9.6% (36)	8.3% (132)
≥High school degree	88.3% (2549)	81.6% (748)	91.5% (1801)	90.4% (338)	91.7% (1463)
Professional situation					
Working	70.5% (2038)	51.7% (475)	79.3% (1562)	82.6% (309)	78.5% (1253)
Unemployed	3.4% (97)	3.9% (36)	3.1% (61)	3.5% (13)	3.0% (48)
Retired	16.7% (482)	22.8% (209)	13.9% (273)	11.2% (42)	14.5% (231)
Student	1.9% (54)	1.3% (12)	2.1% (42)	1.6% (6)	2.2% (36)
Sick leave or disabled	6.5% (189)	18.7% (172)	0.9% (17)	0.5% (2)	0.9% (15)
Others	1.0% (28)	1.5% (14)	0.7% (14)	0.5% (2)	0.9% (12)
Body mass index (kg/m ²)					
Min	12.6	12.6	14.5	15.6	14.5
Median [IQR]	23.2 [21.0–25.9]	23.6 [21.3–25.6]	23.0 [20.8–25.6]	23.2 [21.0–25.7]	22.9 [20.8–25.6]
Max	72.7	72.7	50.7	40.6	50.7
Missing	126	48	78	15	63
Ever seen a nutritionist or a dietician					
Yes	28.6% (790)	32.9% (286)	26.7% (504)	29.8% (107)	25.9% (397)
No	71.4% (1971)	67.1% (584)	73.3% (1387)	70.2% (252)	74.1% (1135)
Missing	126	48	78	15	63
Is currently on a diet					
Yes	11.6% (321)	11.6% (101)	11.6% (220)	11.4% (41)	11.7% (179)
No	88.4% (2440)	88.4% (769)	88.4% (1671)	88.6% (318)	88.3% (1353)
Missing	126	48	78	15	63
Currently under anti-cancer therapies (except endocrine therapy) (cancer patients)					
Yes		23.9% (215)			
No		76.1% (683)			
Feel that they need information about the links between nutrition and cancer (cancer patients)					
In general		19.7% (177)			
At the beginning of their treatments		27.4% (246)			
Throughout the care pathway		35.1% (315)			
At the end of their treatments		5.8% (52)			
No need of information		12.0% (108)			

2.4. Study procedure

The online, self-administered questionnaire was implemented using the anonymous secured survey platform SurveyMonkey©. It was accessible using a single anonymous website link or a QRcode. Between June, 5th and July, 8th 2020, the questionnaire was shared on 2 large French cancer social networks (Patients en réseau, Odyssea). It was also widely proposed to all attendees of Gustave Roussy and their carers, and specifically to attendees of the center's high-risk genetic clinic.

2.5. Ethics and data protection

The study was submitted to Gustave Roussy's local data protection authority acting on behalf of the national Commission Nationale Informatique et Libertés, and approved on May 27th, 2020. All participants were informed of their rights regarding data protection. No identifying data were collected and patients were instructed not to mention any personal detail that would allow to identify them. No signed informed consent was required, but participation was free and voluntary. The study protocol was fully reviewed and approved by Gustave Roussy's Institutional Review Board on May 27th, 2020.

2.6. Statistical analysis

This study was primarily exploratory and descriptive. Thus, no sample size was calculated. Descriptive statistics were conducted in the whole population of respondents, as well as in the three pre-identified categories (cancer patients, high-risk individual, persons from the general population). All data wrangling and analyses were performed using R® version 4.0.1 [30,31].

3. Results

3.1. Population

A total of 2887 individuals answered the survey. Demographic data are shown in Table 1. One third had a cancer history (n = 918), 13% had a high risk of cancer (n = 374) and 55% were in neither situation (general population) (n = 1595). A vast majority were women (87%, n = 2517) and 75% were aged over 50 years. As there was almost no difference in characteristics and answers between high-risk persons and participants from the general population, we chose to present the majority of the results of only 2 groups of participants: cancer patients and cancer-free participants. Eighty two percent of cancer patients (n = 748) and 92% of cancer-free participants (n = 1801) had obtained a high school degree or higher. Among cancer participants, 76.1% (n = 683) had no more active cancer treatment (except endocrine therapy). Sixty-six percent of cancer patients and 46% of cancer-free participants were 50 years or older.

3.2. Nutritional characteristics and dietary habits

The median body mass index of the respondents was 23.2 kg/m² (IQR [21.0e25.9]). Seven hundred and ninety participants (27.4%) had ever seen a nutritionist or a dietician; including 32.9% of cancer patients and 26.7% of cancer-free participants. Eleven percent of participants (n = 321) followed a specific diet at the time of the survey (same proportion in each group of participants) (Table 1). Ongoing diets varied and the more common diet was low carbohydrate diet (n = 89, 28% of all diets), especially among cancer participants (n = 42, 42% of all diets for this population) (Table S1 in supplementary data). Eighty-seven percent of participants declared that they cared about their food (n = 2361, summary of answers “somewhat true”, “true” and “very true”, 85.6% of cancer participants, 88.1% of cancer-free participants) and 68% felt that they lacked information on nutrition in link to cancer/risk of cancer (n = 1853, summary of answers “somewhat true”, “true” and “very true”, 71.3% of cancer participants, 67.3% of cancer-free participants) (Figure 1a and b).

3.3. Beliefs about “nutrition in relation to cancer prevention”

Ninety-three percent (n = 2526) of participants agreed that food can modify cancer risk (summary of answers “rather true”, “true” and “very true”, cancer patients 89%, cancer-free participants 95%). A large proportion of participants considered that nutrition should be personalized according to the risk of cancer (cancer patients 68.7%, general population 65.7%, high-risk participants 59.2%). Twenty-nine percent of participants (n = 792) believed that eating 5 fruits and vegetables a day was enough to avoid cancer, and 64% (n = 1720) thought that dietary supplements could help obtain a better health (Fig. 2 and Table S2 in supplementary data).

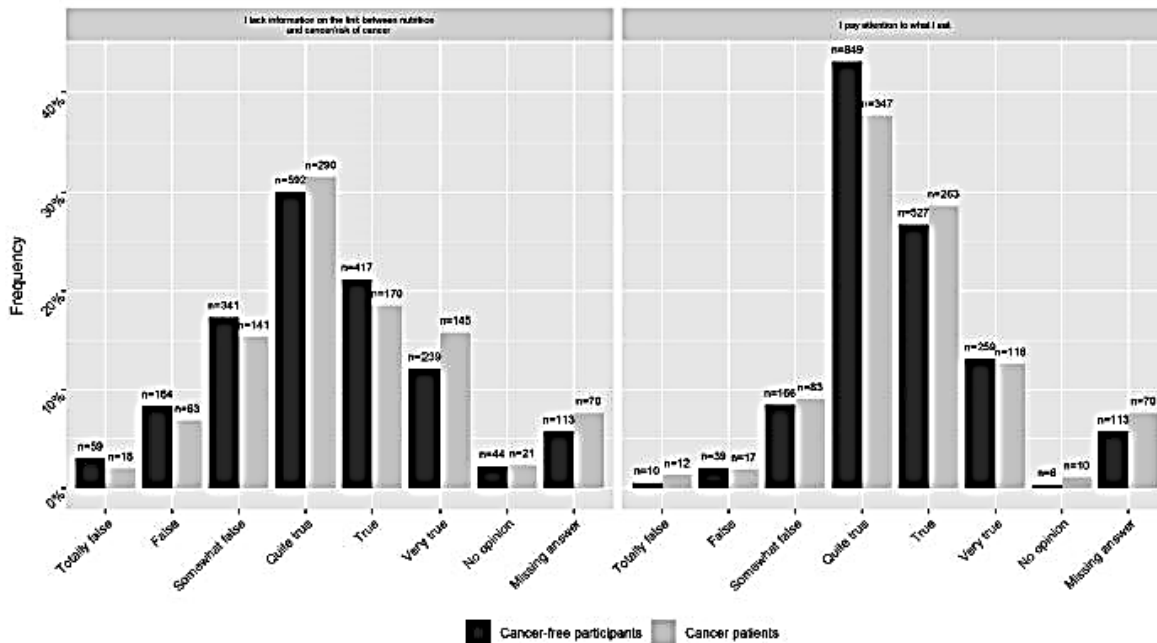


Fig. 1. Nutritional characteristics (all participants).

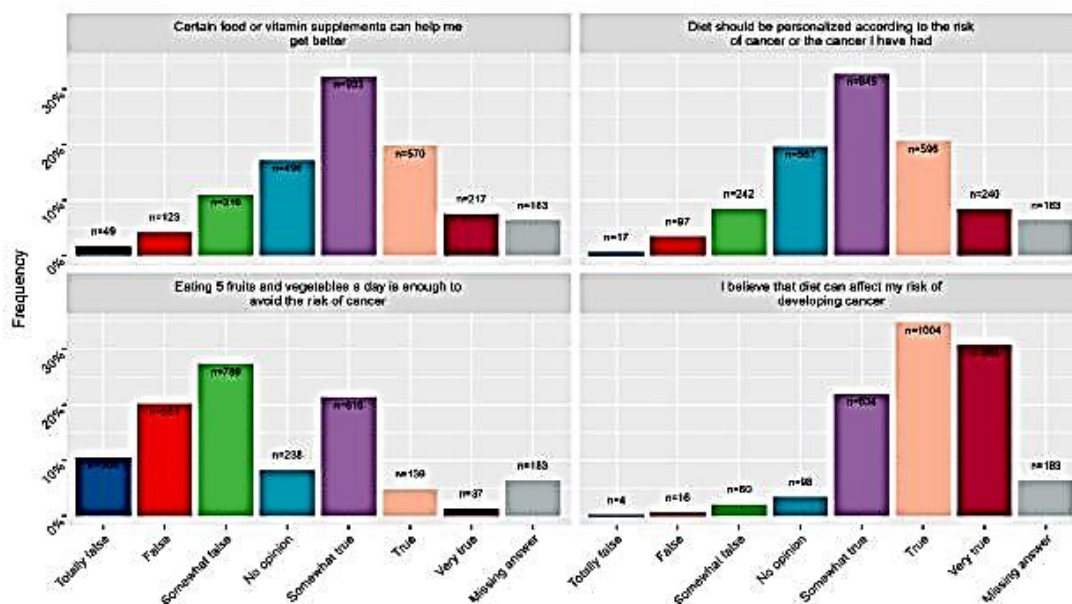


Fig. 2. Beliefs about “nutrition in relation to cancer prevention” (all participants).

3.4. Most important nutrition topics for the participants

A large proportion of participants considered that they lacked information about “nutrition in relation to cancer” (71.3% of cancer participants and 67.3% of cancer-free participants) (Fig. 1b). Only 12% of cancer patients (n = 108) considered they had received enough information on nutrition during their care pathway. Sixty percent of them wished they had received this information at the beginning of their treatment, and 55% throughout the oncological care pathway (Table 1). On average, all proposed topics on nutrition in relation to cancer were considered important by the participants (Fig. 3 and Table S3 in supplementary data). The ranking was as follows: protective food against cancer and relapse of cancer, food at risk of

cancer, role of nutrients, organic food, ultra-processed food, dietary and vitamin supplements were considered important by more than 90% of participants. Nutritional scores and applications, diets and optimal weight were considered important by 75%e90% of participants. Regarding diets, participants were particularly interested in information on intermittent fasting and low carbohydrate diet ([Table S4](#) in supplementary data).

3.5. Preferences regarding information support (multiple choice answers)

The participants demanded to get written information (89.1% of cancer participants and 84.2% of cancer-free participants). Beside this, participants with cancer preferred a face-to-face consultation with a professional (86.2%), whereas cancer-free participants favored recorded content (83.5%). Participants were also interested in working groups on nutrition or culinary recipes. Other ways to be informed, like applications or websites, were less chosen by participants ([Fig. 4](#) and [Table S5a](#) and [b](#) in supplementary data).

4. Discussion

In this cross sectional survey, participants demonstrated a broad interest in “nutrition and cancer prevention” topics. Cancer patients expressed the need to have access to more nutritional information along the continuum of care, during diagnosis, treatment, and post-treatment. A majority of participants were convinced that a healthy nutritional intake could reduce overall cancer risk and that nutritional advice should be tailored according to cancer-specific risk. However, some beliefs about nutrition and cancer prevention appeared incorrect.

Ninety percent of participants were convinced that food has an impact on cancer risk. This is consistent with a recent survey investigating individual perception linked to cancer risk factors, the French Cancer Barometer, which was carried out in 2010 and 2015 [32]. In this study, diet was perceived as having an important role in cancer development for 91% of surveyed, with a greater perception of nutritional risk factors in 2015 compared to 2010. Similarly, a survey among Chinese cancer patients, showed that 95% of them thought that it was important to have a good dietetic habit [33].

Although all participants had globally the same answers, we can see some small differences between cancer participants and cancer-free participants. Compared to cancer-free participants, more cancer participants considered that diet should be personalized according to the risk of cancer. One explanation is that some cancer localisations require adapted diet, for example parenteral nutrition. There are also increased evidence that diet reduces cancer-mortality in cancer survivors, although most studies were in breast cancer survivors [34,35]. Cancer patients also had greater interest in learning more about optimal weight and specific diets. This could be partly explained by the fact that most oncology providers advise patients to maintain a healthy weight or to lose weight if overweight and to eat a balanced diet, during active treatment and after completion of active therapy, as showed by a survey among oncologists in the United States [36], although rates of referrals of patients to weight management or nutrition programs were low.

Seventy-five percent believed that dietary supplements could help achieve good health. Dietary supplements are trendy topics in the media [37]. Following the latest scientific

knowledge, a balanced and diversified diet should provide all necessary nutrients, and there is no need to use dietary supplements except in disease states such as malabsorption and some other pathologic conditions [8]. It has also been demonstrated that dietary supplements could increase the risk of certain types of cancer (such as beta-carotene supplementation and risk of lung cancer among smokers [38]) and could also cause drug interactions. This strong and prevalent misbelief of the positive role of non-targeted nor individualized dietary supplements for many different purposes is present in all health fields and a matter of research and education plans especially targeting the youngest [39].

Among other misbeliefs, nearly a third of participants believed that eating 5 fruits and vegetables a day was enough to avoid cancer. This misconception may reflect a lack of updated information on nutritional recommendations in relation to cancer prevention and health in general. ‘Optimal’ diet is not absolute and relies on country-specific culture and ethnicity. Each country has its own definition of a “good” diet and translates them into easily understandable food-based dietary guidelines [40]. International consensus however allow to define which food groups should globally be promoted or limited in order to minimise the risk of non-communicable diseases, and most guidelines recommend high consumption of fruits, vegetables but also consumption of wholegrains and low intake of meats, fats, sugary and salted foods [22,40,41]. The French dietary recommendations were updated in 2017 [42] and fully take into accounts these latest aspects, but until that time the main and sometimes only message concerned the “5 fruits and vegetables per day” recommendation, which may explain the persistence of this belief.

Eleven percent of participants declared following a specific diet at the time of the questionnaire. A small proportion could have been prescribed a diet due to medical conditions, but the main diets were low carbohydrate diets and weight loss diets, which is consistent with a French study from the Nutrin et-Santé cohort, where 26.7% of participants had followed at least one weight-loss diet in the last 3 years [43]. Although widely practiced by cancer survivors [44], these diets, if not medically driven, can be toxic, especially for cancer patients, for whom avoiding denutrition and sarcopenia is a major prognostic factor [45,46].

According to the participants, their preferred way to receive information about nutrition and cancer was through a written content. A recent study among breast cancer patients showed that a fact sheet with basic information on nutrition could satisfy patients’ need for information [47]. Cancer participants had a preference for face-to-face consultation with a professional, compared to cancer-free participants. A lot of participants expected that healthcare professionals should be able to answer their questions about nutrition to effectively satisfy their expectations (answers to free comments in the survey, data not shown) [48]. Individuals are becoming more aware of the importance of nutrition before, after, and during cancer and seek more nutrition-related information. Therefore, it is pivotal to fill knowledge deficit of patients with the right nutrition information and/or education to improve knowledge, modify dietary behaviour and improve health outcomes [49]. However, to enhance information provision it would seem appropriate to minimize information overload characterized by a lot of information often contradictory [50].

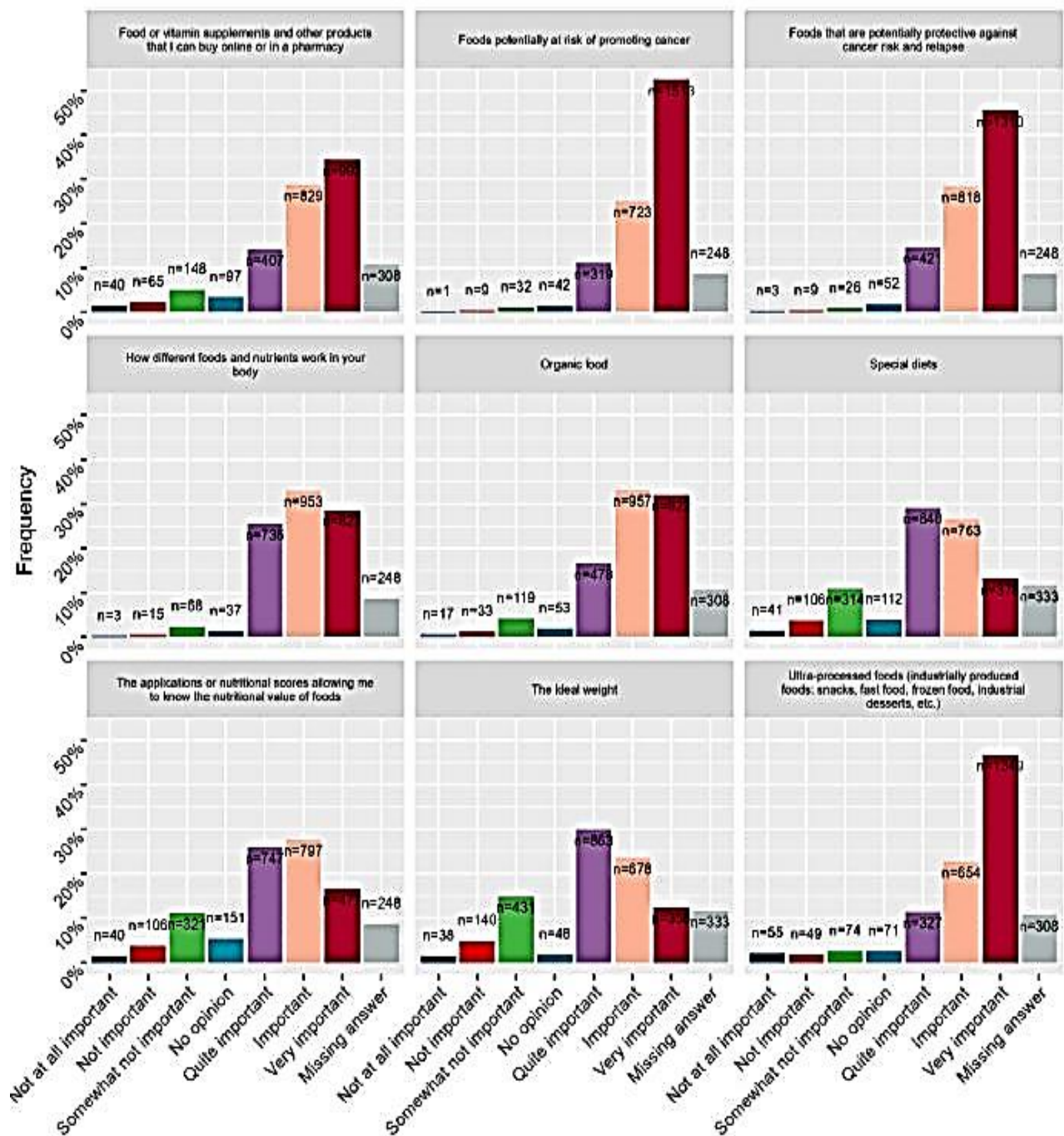


Fig. 3. Nutritional topics (all participants).

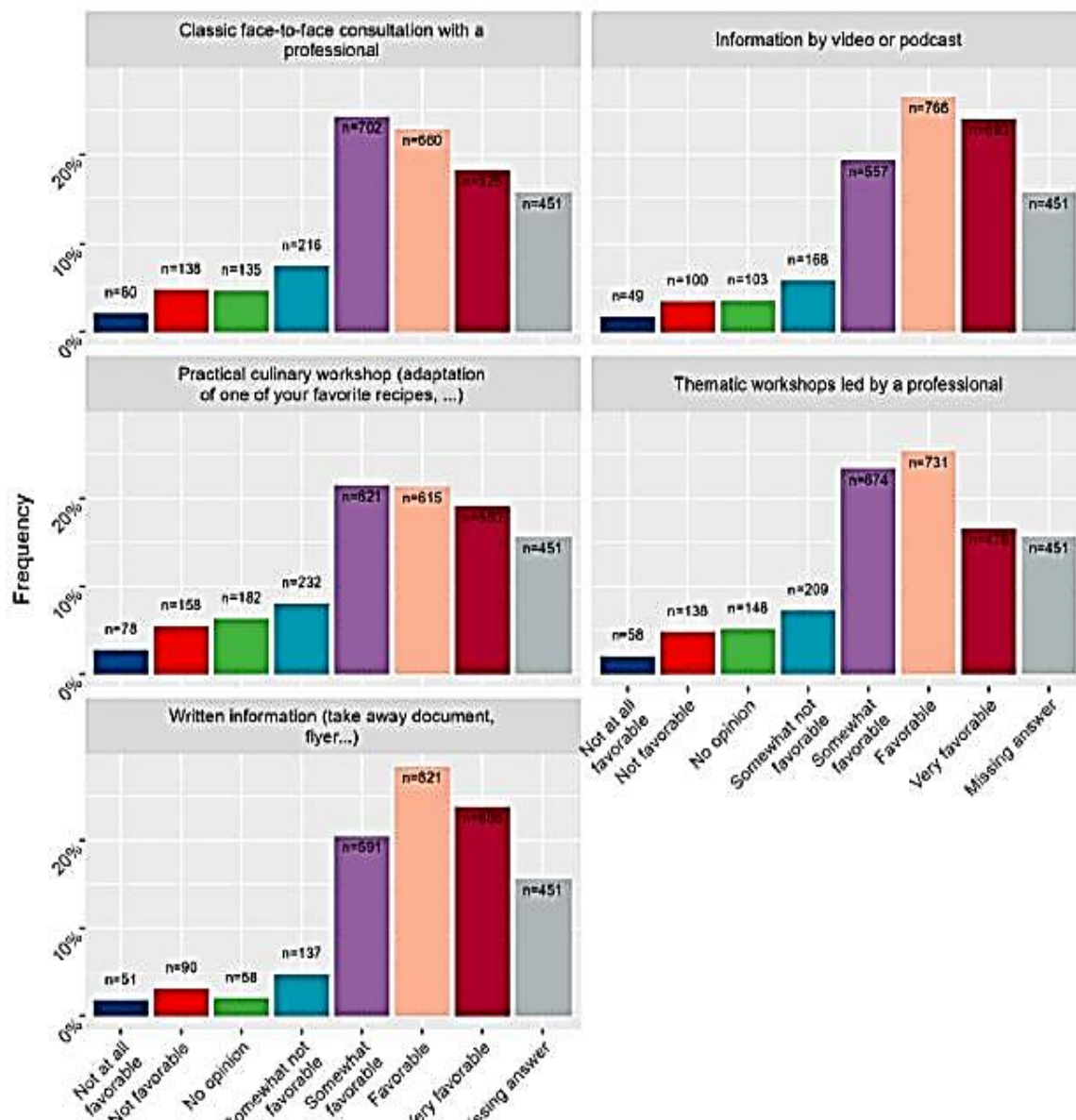


Fig. 4. Information channels (multiple choice answers, all participants).

Guidelines have emerged in the past few years on good lifestyle habits to reduce the risk of cancer [1,51]. They mainly include recommendations on food, tobacco, alcohol, weight and physical activity. Some nutritional scores have also been developed: among them the World Cancer Research Fund (WCRF) score seems to correlate best with cancer risk [52]. Nutritional recommendations also exist for cancer patients [22]. However, they are different in the setting of on-going cancer treatment, because of potential drug/ plants interaction, diminished digestion due to treatment toxicities, weight loss, etc. They also can be adapted to some types of cancers and treatment (parenteral nutrition or use of hyperproteinic supplement for example).

This study has important strengths. First, it is based on a large sample size and was able to capture opinions from various populations (cancer patients, high-risk population, general

population). Second, it investigates a broad sample of items on “nutrition and cancer”: from beliefs to topics of interest and ways to obtain information, in order to better tailor nutrition information and future interventions. The results of our study are however to be interpreted keeping in mind several limitations. First, our population suffers from self-selection bias, as the vast majority of participants were women and were highly educated. While it is well known that women have more interest in health than men, and especially in nutrition, the networks we solicited were largely populated with women. Most participants also had a healthy average BMI and a quarter of them had already seen a dietitian during their life, which shows their interest in a healthy lifestyle. Second, as for all surveys, we cannot exclude respondents’ biases. Indeed, the individuals who respond to surveys are particularly interested in the topic and may have already sought information. These biases do not invalidate our results but may limit their extrapolation to different populations.

5. Conclusion

Cancer patients as well as cancer-free people seek more information on nutrition and cancer prevention. They come with beliefs that are sometimes false. Practitioners should be educated regarding the role of nutrition during all the stages of cancer trajectories including primary cancer prevention, to enhance information provision and meet the nutrition information needs of patients in their daily routine practice.

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Authorship

Veron: conceptualization, methodology, investigation, writing-original draft; Chaltiel: methodology, formal analysis, visualization, writing e review and editing; Raynard: conceptualization, methodology, writing-review and editing; Rassy: conceptualization, methodology, writing-review and editing; Scott_e: conceptualization, methodology; Charles: conceptualization, methodology, writing-review and editing; Pons: conceptualization; De Jesus: conceptualization; Accolas: conceptualization, investigation; Bergounoux: conceptualization, investigation; Caron: conceptualization, methodology, writing-review and editing, project administration, supervision; Delaloge: conceptualization, methodology, writing-review and editing, project administration, supervision.

Declaration of competing interest

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