



## Article

# Japanese Magazine Articles on Lifestyle Factors Associated with Fertility: A Content Analysis

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**Abstract:** Knowledge of the contributing factors of infertility is essential to optimizing the reproductive health of the population. Magazines are a major source of informational health messages; this study quantitatively and inductively examined the information in Japanese fertility-related magazine articles on modifiable lifestyle and risk factors associated with fertility. We conducted a content analysis in two major fertility-related magazines published between 2014 and 2020 that individuals attempting to conceive were likely to read. We also identified evidence-based lifestyle factors associated with reduced fertility after reviewing the scientific literature. In total, 76 lifestyle factors were mentioned in the magazine articles. A total of 9 of these 10 evidence-based lifestyle risk factors were among the 20 factors most frequently mentioned. Thus, the evidence-based lifestyle factors were well-discussed, but the articles focused heavily on nutritional factors. Health check-ups were not covered as extensively as nutrition and diet, although physical examination can uncover physiological causes of infertility. Some lifestyle factors in the articles had not been sufficiently scientifically examined. Too many recommendations were given in the magazine articles. This may induce a feeling of being overwhelmed in readers. The publishers of magazines should provide balanced information, consider prioritizing lifestyle factors by conclusive scientific evidence, and disseminate accurate information.

**Keywords:** reproductive health; preconception health; fertility; lifestyle factor; magazine; health communication



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## 1. Introduction

The term ‘reproductive health’ was first defined internationally by the United Nations International Conference on Population and Development in 1994 [1,2]. This definition is similar to the general definition of ‘health’ published by the World Health Organization (WHO), which incorporates the reproductive dimension and aspects of physical, mental, and social well-being [1]. Therefore, reproductive health has been proposed as a concept that includes concerns about infertility. In 2006, the Centers for Disease Control and Prevention defined ‘preconception health’ as the health of women and men of reproductive age who are able to bear children [3–5]. This concept explicitly covers all women and men, regardless of whether or not they plan to have children. A WHO report from 2013 presented a package of preconception care interventions [6], which included increasing awareness and understanding about fertility and infertility, and the preventable causes of infertility [6]. Thus, the health of women and men before pregnancy is gradually being recognized as a global public health topic. To optimize the fertility-related health of reproductive-aged individuals and fertility-related decision-making, access to accurate information is essential [7].

Infertility refers to the inability to conceive despite 12 months of regular unprotected sexual intercourse [8]. Approximately 186 million individuals worldwide are believed to

be infertile [9]. In Japan, approximately one-third (35.0%) of couples are presently or were previously concerned about infertility [10]. This may be related to Japan's low total fertility rate, high average age of the first marriage, and high average age of mother at the birth of her first child. Japan's total fertility rate in 2019 was 1.36, which was internationally low compared to other countries [11]. The average age of the first marriage for Japanese wives and husbands was 24.7 and 27.0 years old, respectively, in 1975, but 29.6 and 31.2 years old, respectively, in 2019 [12]. The average age of mother at the birth of her first child in Japan was also 25.7 years old in 1975, but it was 31.2 years old in 2019 [12]. Such demographic information describes the actual behaviors related to postponement and refraining from childbearing that contributes to infertility. In addition to age, previous studies found that lifestyle factors associated with fertility were sexually transmitted infections, psychological stress, cigarette smoking, alcohol use, nutrition and diet, physical activity (any movement that exerts more energy than the resting state) and exercise (physical activities that are planned, deliberate, and continuous for the purpose of maintaining and improving physical strength), being underweight, overweight, or obese, and environmental pollution [8,13].

According to a 2013 survey in Japan, 60–70% of respondents were aware that women's fertility declines with age, but 60–70% did not know that cigarette smoking reduces fertility in both men and women and 80–90% were not aware that a female being overweight reduces fertility [14]. This study also suggested that the lack of knowledge regarding fertility in a reproductive-aged population is reflected in the presentation of inaccurate information by mass media [14]. Moreover, in a later survey conducted in Japan, 60.3% of respondents indicated that they were not confident in their ability to discern and understand information on fertility and pregnancy [15].

Mass media such as television, newspapers, and magazines play a major role in shaping people's behavior. In our encounters with people in everyday life, people pay attention to the cues presented by others and consider their later behavior [16]. This attitude toward behavior is reinforced by mass media such as television, newspapers, and magazines [16]. That is, people interpret their behavior through interactions between individuals, but the overlapping interactions at the social level of the mass media reinforce the idea of later behavior [16]. Another possible medium for influencing people's behavior is social networking services (SNSs). However, according to a 2018 survey, only 20–35% of 20–40 year olds trusted information on the SNSs [17]. As with TV information programs, magazine articles were trusted by approximately 40% of people aged 20–40 [17]. The impact of information in magazines on people's behavior is likely to be significant because the credibility of information is related to people's later behavior [18].

Among the mass media, magazines are still a major source of health information, especially for women [19,20]. It is apparent that fertility magazines are also a source of information for those considering pregnancy in Japan. One Japanese fertility magazine had a circulation of 40,000 copies in 2017 [21]. Many of these magazines also distribute information in magazines on the internet. A magazine had more than 100,000–300,000 total page views per month in 2016 [21]. While magazine readers shape health behaviors through people's interactions, it is likely that these behaviors are reinforced by information in fertility magazines. Magazine contents can influence readers' health behaviors [20], so fertility- and infertility-related information in magazines may affect reader's knowledge concerning conception.

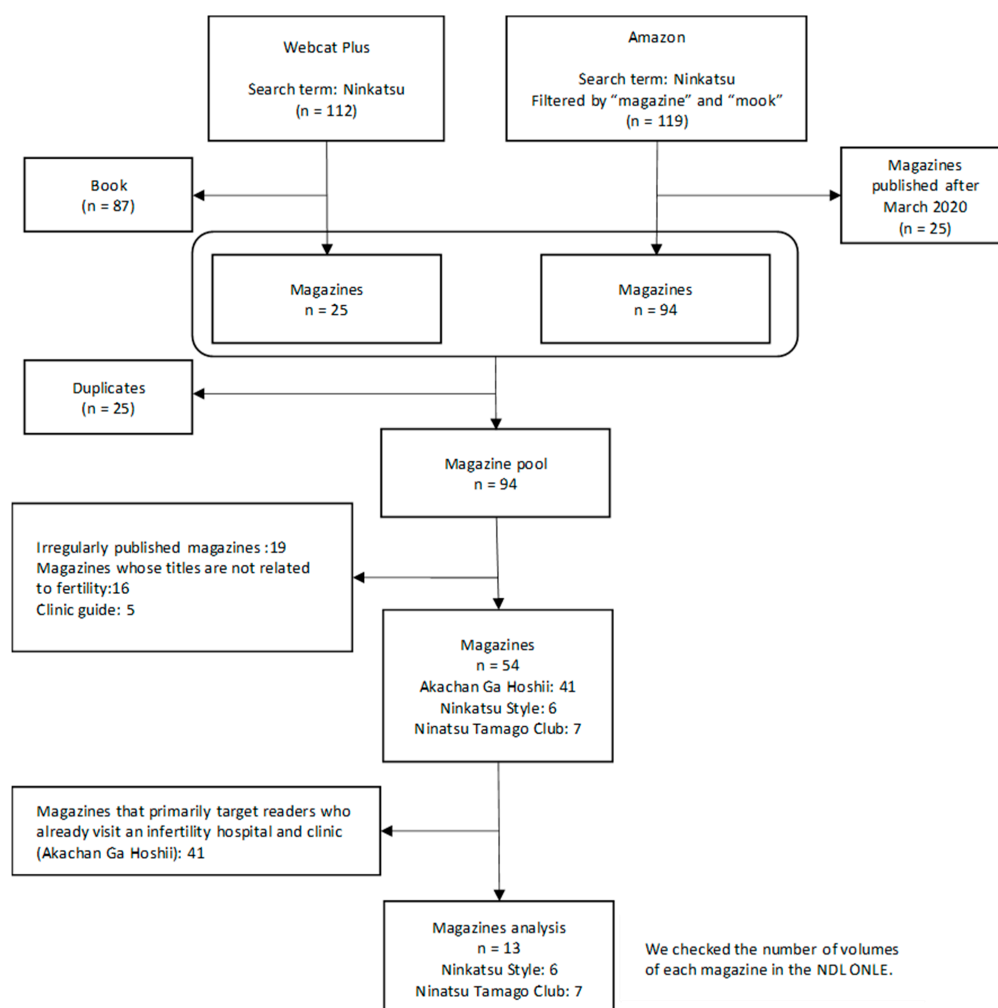
Previous studies on infertility information analyzed online information on lifestyle factors associated with reduced fertility [22], newspaper articles on assisted reproductive technology [23], the readability, suitability, and quality of online information on infertility [24,25], and infertility-related videos [26]. Individuals diagnosed with infertility may obtain accurate information from healthcare providers. However, to our knowledge, no published studies have assessed information published in magazines that target individuals who wish to conceive but have not been examined at an infertility hospital or clinic (magazine articles aimed at primary/secondary prevention of infertility and preconception health). For a population approach to prevent infertility, providing accurate information through magazines may be essential. In addition, repeated exposure to a stimulus rein-

forces an individual's attitude (e.g., favorable) toward that stimulus [27–29], meaning it is important to verify the frequency of the words or terms used. Therefore, it is necessary to identify lifestyle factors to which those considering pregnancy who have not yet visited an infertility hospital or clinic may be more frequently exposed. For this purpose, quantitative content analysis is more appropriate than interpretative approaches such as thematic analysis. Accordingly, in this study, we quantitatively, inductively, and comprehensively examined the information in Japanese fertility-related magazine articles on lifestyle factors associated with fertility for primary/secondary prevention of infertility and preconception health. Knowing what kind of information that a patient visiting an infertility hospital or clinic for the first time may have been exposed to and influenced by could have a positive impact on mutual understanding in patient–healthcare provider relationships.

## 2. Materials and Methods

### 2.1. Study Design

The flow diagram of the magazine selection is shown in Figure 1. To select publications for analysis, we used Webcat Plus (<http://webcatplus.nii.ac.jp/> (accessed on 17 May 2020)), which is a service provided by the National Institute of Informatics, and Amazon (<https://www.amazon.co.jp/> (accessed on 17 May 2020)), an online shopping service. Webcat Plus provides information on publications in an organized form by integrating various sources of information about publications held by 1000 university libraries nationwide and the National Diet Library. Amazon is a leading online shopping service in Japan and had more than 310 million active customers worldwide in 2017 [30].



**Figure 1.** Flow diagram of the magazine selection.

First, we entered the word “Ninkatsu” (trying to conceive) in an “associative search”, which is a feature of Webcat Plus that seeks relevant information by example. People in English-speaking countries often use the term “fertility”, whereas people in Japanese-speaking countries do not often refer to fertility (ninyosei). Therefore, we searched Webcat Plus using “Ninkatsu” (trying to conceive) and extracted publications associated with this term. We further entered “Ninkatsu” (trying to conceive) into the Amazon search facility, with “magazine” and “mook” as the filter. We excluded books, magazines published after March 2020, magazines that were not published more than once a year, and clinic guides. This search returned the three magazines (“Akachan Ga Hoshii”, “Ninkatsu Style”, “Ninkatsu Tamago Club”). These three magazines are well-known to the Japanese public, and sources of information on the other search results were scarce. Three relevant magazines were selected from the results returned.

We analyzed two of them (“Ninkatsu Tamago Club” and “Ninkatsu Style”) because their target readership is individuals who are attempting to conceive but have not been examined at an infertility hospital and clinic. The other magazine (“Akachan Ga Hoshii”) was excluded because this target readership is individuals who already visited an infertility hospital and clinic. In fact, according to the media information of Akachan Ga Hoshii published in 2020, 69% of readers responded that they regularly visit or used to regularly visit a hospital or clinic for infertility treatment [31]. It is likely that the readership of this magazine were those who have been examined at an infertility hospital or clinic. The negative effect of including Akachan Ga Hoshii in the analysis is that it would include articles about infertility patients getting pregnant. That is, it would not allow for an accurate analysis of articles about the primary/secondary prevention of infertility, and preconception health. Therefore, Akachan Ga Hoshii was not included in the analysis. “Ninkatsu Tamago Club”, published by Benesse Corporation, was launched in 2014 and has a circulation of approximately 40,000 with one issue in 2017 [21]. The target audience is women and men who are considering pregnancy [21]. This magazine is targeted at people who are beginning to think about having a child soon [21]. The subtitle of the magazine clearly states that it is “the first book you read when you want a baby”. Due to this subtitle written prominently on the magazine’s cover, its readership is presumed to be those who wish to conceive but have not been to an infertility hospital or clinic. The total page views of the website publishing articles based on this magazine (“Tamahiyo No Ninkatsu Site”) was 100,000–300,000 per month in 2016 [21]. “Ninkatsu Style,” published by Cosmics Publications (“kosumikku syuppansya”) launched in 2014 and has a circulation of 35,000 with about one issue per year [32]. The concept of this magazine is to prepare the mind and body for the birth of a healthy baby not only before conception, but also during the period between conception and delivery [32]. The magazine’s cover prominently features the message “the bible for all married couples”. Similarly, the cover of the magazine features a message to those who wish to conceive but are not yet visiting an infertility hospital or clinic (e.g., “how to conceive naturally in the shortest amount of time?” (2019)). Therefore, its readership is presumed to be those who wish to conceive but have not been to a fertility hospital or clinic. Therefore, in Japan, these two magazines and the internet are the main sources of information for people who have not yet visited a relevant hospital or clinic, but wish to conceive (the target of this study). Finally, we entered the magazine titles of these two magazines in the National Diet Library’s NDL Online and verified that the number of volumes of each magazine was accurate [33]. Since all publications published in Japan are required to be delivered to the National Diet Library, we confirmed that there were no missing volumes of magazines [34]. We, therefore, analyzed a combined total of 7 years of publications (13 volumes) of the two magazines, published up to March 2020. The number of volumes of “Ninkatsu Tamago Club” to be analyzed was 7: magazines between the first publication of 2014 and 2020 (March 2014, March 2015, March 2016, March 2017, March 2018, March, 2019, March 2020). The number of volumes of “Ninkatsu Style” to be analyzed was 6: August 2014 (the first publication), January 2016, July 2017, January 2018, July 2018,

and January 2019. All magazine issues were purchased by the first author in the spring of 2020.

All magazine articles that specifically provided fertility-related advice to those wishing to conceive but who had not been examined at an infertility hospital or clinic (articles aimed at primary/secondary prevention of infertility and preconception health) were included in the analysis. We excluded articles on travel, shrines, charms, and fortune-telling, articles on the impact of lifestyle factors on in vitro fertilization outcomes, articles on the post-pregnancy period, descriptions of subsidies for fertility treatments and childbirth, and articles targeting those visiting hospitals and clinics and those who are already pregnant. After excluding these articles, 649 articles remained for analysis.

## 2.2. Selection of Lifestyle Factors Associated with Fertility

As noted in the introduction, it is important to increase awareness of and understanding about fertility and infertility and the preventable causes of infertility [6]. Therefore, this paper focused on lifestyle factors associated with fertility covered by fertility-related magazines. In this study, lifestyle factors were defined as changeable factors in daily life that affected the chance of healthy childbearing for those who wanted to conceive [8]. There are no guidelines in Japan regarding evidence-based lifestyle factors associated with fertility. We used information from the Japan Society of Obstetrics and Gynecology [35], the Ministry of Health, Labour and Welfare [36], the Cochrane Library [8], the British Fertility Society [37], and previous research [13,38–42] on evidence-based lifestyle factors associated with fertility. After discussing the list of factors with two obstetricians/gynecologists, we selected the following factors: age, sexually transmitted infections, psychological stress, cigarette smoking, alcohol use, nutrition and diet, physical activity and exercise, being underweight, overweight, or obese, and environmental pollutants. Table S1 lists major references supporting the selection of these factors.

## 2.3. Coding Procedure

We analyzed the magazine data between 17 May and 30 June 2020 by the following procedure. Author RY carefully read all articles and identified and listed the lifestyle factors associated with fertility inductively as coding items. RY then collected and stored information such as magazine name, date of publication, page number, and coding items in Microsoft Excel. When information on lifestyle factors associated with fertility was described in an article, a code of 1 was assigned to the item. When no such information was described, a code of 0 was assigned. Table S2 lists the items used. Since the number of lifestyle factors listed was expected to be large, RY reclassified them into larger categories for the purpose of understanding the overall trend.

## 2.4. Inter-Coder Reliability

To determine inter-coder reliability, two independent coders (authors RY and EF) assessed approximately 20% of the final dataset (131 out of 649 articles, 20.2%) that were selected at random. That is, all articles to be analyzed in this study were numbered, and random numbers were generated using Microsoft Excel to determine the articles that were included in the analysis of inter-rater reliability. Articles that are subject to inter-rater reliability are listed below, covering all publication periods: 17 articles published in 2014, 8 articles published in 2015, 18 articles published in 2016, 25 articles published in 2017, 31 articles published in 2018, 21 articles published in 2019, and 11 articles published in 2020. Author EF was provided with approximately 1 h of training on the coding system developed by author RY. In a pilot test step, RY and EF assigned codes to 10 articles selected at random from the entire dataset. We detected no major problems in this step. After a completion of reliability evaluation step, RY estimated the inter-coder reliability index. To determine inter-coder reliability, inter-coder agreement was measured by Gwet's AC1 statistic, which is less sensitive to prevalence than Cohen's Kappa [43]. The analysis was conducted using R for Windows (version 3.5.1).



Inter-coder agreement was found in 9523 of 9956 coding instances in the 131 articles selected (95.65%). Gwet's AC1 statistic was within the range 0.602–1.000 (mean: 0.941) for the lifestyle factors associated with fertility, indicating excellent inter-coder agreement. The coding of the first author was then used for data analysis.

### 3. Results

#### 3.1. Descriptive Statistics

The total number of pages to be analyzed was 1298 of 1798 pages in 13 magazine issues. The total number of articles was 649 articles. From these, we identified 76 lifestyle factors associated with fertility that were covered in the analyzed articles. The number of codes assigned to each article ranged from 1 to 32 (median: 3). The total number of codes assigned was 2737.

#### 3.2. Distribution of Lifestyle Factors Associated with Fertility

Table 1 summarizes the distribution of lifestyle factors associated with fertility covered in the magazine articles. The 10 most frequently mentioned factors were nutrition and diet (10.85%, 297 of 2737 codes; e.g., fatty foods, cold foods); psychological stress (7.96%, 218 of 2737 codes; e.g., stress at work, anxiety about the future); hypersensitivity to cold (6.69%, 183 of 2737 codes; e.g., coldness, hot activity); age (5.77%, 158 of 2737 codes; e.g., egg aging, time limits); health check-up (5.26%, 144 of 2737 codes; e.g., semen testing, Huhner test); physical activity and exercise except yoga (5.01%, 137 of 2737 codes; e.g., muscle training, hula hoops); nutritional supplements (4.82%, 132 of 2737 codes; e.g., docosahexaenoic acid, gamma-aminobutyric acid); consumption of the herbal medicine kampo (3.07%, 84 of 2737 codes; e.g., Jusen-tai-ho-to, unkeito); sleeping habits (2.96%, 81 of 2737 codes; e.g., lack of sleep, inability to sleep); and basal body temperature (2.96%, 81 of 2737 codes; e.g., measuring basal body temperature).

**Table 1.** Distribution of lifestyle factors associated with fertility in fertility magazine articles.

No.	Lifestyle Factors	Broad Category <sup>a</sup>	<i>n</i> <sup>b</sup>	%
1	Nutrition and diet	A	297	10.85
2	Psychological stress	C	218	7.96
3	Hypersensitivity to cold	E	183	6.69
4	Age	I	158	5.77
5	Health check-up	F	144	5.26
6	Physical activity and exercise (except yoga)	H	137	5.01
7	Nutritional supplements	A	132	4.82
8	Consumption of the herbal medicine Kampo	B	84	3.07
9	Sleeping habits	D	81	2.96
10	Basal body temperature	G	81	2.96
11	Alcohol use	L	69	2.52
12	Acupuncture and moxibustion	B	67	2.45
13	Non-caffeinated beverage intake	A	63	2.30
14	Smoking cigarettes and exposure to second-hand smoke	M	62	2.27
15	Sexual behavior	K	58	2.12
16	Underweight	J	54	1.97
17	Sexually transmitted infections	N	52	1.90
18	Life planning (pregnancy and childbirth)	G	50	1.83
19	Overweight and obesity	J	48	1.75
20	Yoga	H	43	1.57
21	Body work and osteopathy	B	39	1.42
22	Bathing	D	38	1.39
23	Aromatherapy (essential oils)	B	37	1.35
24	Health management with partner	G	37	1.35
25	Regular routine (e.g., “early to bed, early to rise”)	D	35	1.28
26	Fatigue	C	34	1.24
27	Body deformation	B	29	1.06
28	Underwear	O	21	0.77
29	Masturbation	K	20	0.73
30	Caffeine intake	A	19	0.69

Table 1. Cont.

No.	Lifestyle Factors	Broad Category <sup>a</sup>	<i>n</i> <sup>b</sup>	%
31	Knowledge of medical and family history	G	18	0.66
32	Computer use	D	17	0.62
33	Scrotal heat	P	17	0.62
34	Hypothermia	E	16	0.58
35	Vaccination	F	15	0.55
36	Clothing	O	15	0.55
37	Tightening the body	O	14	0.51
38	Massage	B	13	0.47
39	Exposure to the sun and tanning	D	13	0.47
40	Medication	F	13	0.47
41	Consuming herbs	B	11	0.40
42	Sauna use	D	11	0.40
43	Riding a bicycle	D	11	0.40
44	Infections (except sexually transmitted infections)	N	11	0.40
45	Esthetic clinic	B	10	0.37
46	Job	D	10	0.37
47	Footwear	O	9	0.33
48	Environmental pollution	Q	9	0.33
49	Crossing the legs	D	8	0.29
50	Obstetrician/gynecologist as primary-care physician	F	8	0.29
51	Smartphone use	D	7	0.26
52	Meditation	C	7	0.26
53	Psychoactive medication use	F	7	0.26
54	History of lower abdominal surgery	F	7	0.26
55	Phototherapy	B	5	0.18
56	Breathing exercises	C	5	0.18
57	Owning a pet	D	5	0.18
58	Holding a bag	D	5	0.18
59	Dental care	F	5	0.18
60	Vaginal care	B	4	0.15
61	Highly concentrated vitamin C infusion	B	4	0.15
62	Long hours of driving	D	4	0.15
63	Karaoke	D	4	0.15
64	Listening to music (onkatsu)	D	4	0.15
65	Illicit drugs (kiken dorakku)	M	4	0.15
66	Laser therapy	B	3	0.11
67	Oxygen capsule use	B	3	0.11
68	Psychological care/counseling	C	3	0.11
69	Household chemicals	Q	3	0.11
70	Sitting on the train	D	2	0.07
71	Excessive information seeking on the Internet	D	2	0.07
72	Salt ball (shio bouru) massage	B	1	0.04
73	Autogenic training	C	1	0.04
74	Using a vacuum cleaner	D	1	0.04
75	Side-sleeping or lying face down on the floor	D	1	0.04
76	Qigong (Chinese mind-body exercise and meditation)	H	1	0.04
	Total		2737	

<sup>a</sup> A: nutritional factors, B: alternative medicine, C: psychological factors, D: factors related to daily life, E: hypersensitivity to cold, F: healthcare-related factors, G: life planning and health management, H: physical activity and exercise, I: age, J: overweight and underweight, K: factors related to sexual behavior, L: alcohol use, M: cigarette smoking and substance use, N: infectious diseases, O: factors related to clothing, P: scrotal heat, Q: chemical-related factors. <sup>b</sup> *n* refers to the number of codes per factor.

### 3.3. Evidence-Based Lifestyle Factors Associated with Fertility

Table 1 shows that 9 of the 10 evidence-based lifestyle factors associated with fertility appear in the 20 most frequently mentioned lifestyle factors that were abstracted from the articles: nutrition and diet (10.85%, 297 of 2737 codes), psychological stress (7.96%, 218 of 2737 codes), age (5.77%, 158 of 2737 codes), physical activity and exercise except yoga (5.01%, 137 of 2737 codes), alcohol use (2.52%, 69 of 2737 codes; e.g., excessive drinking causes erectile dysfunction), smoking cigarettes and exposure to second-hand smoke (2.27%, 62 of 2737 codes; e.g., e-cigarettes), being underweight (1.97%, 54 of 2737 codes; e.g., excessive dieting), sexually transmitted infections (1.90%, 52 of 2737 codes; e.g., syphilis, gonorrhea), and being overweight and obesity (1.75%, 48 of 2737 codes; e.g., overeating).

### 3.4. Potentially Unbalanced and Inaccurate Information

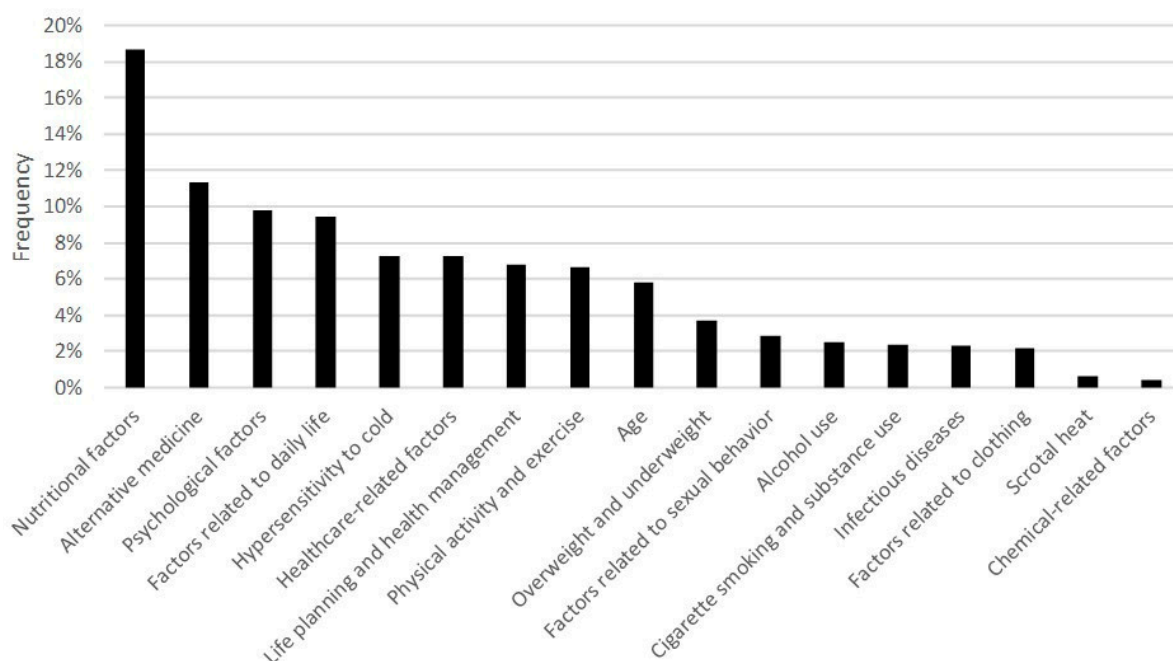
Nutrient-related factors such as nutrition and diet, nutritional supplements, non-caffeinated beverage intake (e.g., green juice, almond juice), and caffeine intake (e.g., energy drinks, coffee) account for an exceptionally high percentage (18.67%, 511 of 2737 codes). Although health check-ups are important because physical examination can uncover physiological causes of infertility [44], there are fewer mentions of health check-ups (5.26%, 144 of 2737 codes) than of nutrition and diet (10.85%, 297 of 2737 codes), psychological stress (7.96%, 218 of 2737 codes), and hypersensitivity to cold (6.69%, 183 of 2737 codes).

Lifestyle factors specific to women such as hypersensitivity to cold (6.69%, 183 of 2737 codes), basal body temperature (2.96%, 81 of 2737 codes), and body deformation (1.06%, 29 of 2737 codes) were more frequently cited than lifestyle factors specific to men such as computer use (0.62%, 17 of 2737 codes) and scrotal heat (0.62%, 17 of 2737 codes).

The magazine articles mentioned lifestyle factors for which there is insufficient evidence of an association with fertility, such as sleeping habits (2.96%, 81 of 2737 codes), use of aromatherapy oils (1.35%, 37 of 2737 codes; e.g., essential oils), massage (0.47%, 13 of 2737 codes; e.g., bowel massage), crossing the legs (0.29%, 8 of 2737 codes; e.g., distortion of the body from crossing legs), and holding a bag (0.18%, 5 of 2737 codes; e.g., dispersion of weight of luggage).

### 3.5. Overall Trend of Mentions of Lifestyle Factors

To understand overall trend in the mentions of lifestyle factors, Figure 2 and Table S2 (broad category) show the results after reclassifying the 76 identified factors into 17 categories. When examined in detail, evidence-based factors are well-discussed, but when examined in the context of the larger categories, some evidence-based factors are less frequently cited, including being overweight and underweight (3.73%, 102 of 2737 codes), alcohol use (2.52%, 69 of 2737 codes), cigarette smoking/substance use (2.41%, 66 of 2737 codes), and infectious diseases (2.30%, 63 of 2737 codes).



**Figure 2.** Seventeen lifestyle factors associated with fertility mentioned in fertility-related magazines.

## 4. Discussion

This is the first study to conduct a quantitative, inductive, and comprehensive examination of information about the lifestyle factors associated with fertility drawn from articles



in Japanese fertility-related magazines (articles aimed at primary/secondary prevention and preconception health).

A total of 9 of the 10 evidence-based lifestyle factors associated with fertility appeared in the 20 most frequently mentioned factors abstracted from the articles. Chemical-related factors (e.g., dioxin, PM2.5) are a risk factor for reduced fertility [45,46], but there is little mention of these factors in the magazine articles. It is possible that the magazine editors did not cover chemical-related factors because they did not consider them to be factors that could be modified by readers. With the exception of chemical-related factors, evidence-based lifestyle factors were covered in the magazine articles. However, the 10 evidence-based lifestyle factors were limited to 52.25% of mentions (1430 of 2737 codes). The publishers should emphasize these factors so that readers can prioritize their efforts. In particular, the mentions of being overweight and underweight (3.73%, 102 of 2737 codes), infectious diseases including sexually transmitted infections (2.30%, 63 of 2737 codes), and cigarette smoking and substance use (2.41%, 66 of 2737 codes) should be increased to reflect the situation in Japan. That is, more than a quarter of men of reproductive age are obese, 10–20% of women of reproductive age are underweight, and approximately 20% of the population smokes cigarette [47]. The number of syphilis cases is also increasing rapidly [48].

Among the factors mentioned in the magazine articles, there were many descriptions of hypersensitivity to cold, such as coldness and warmth activity (6.69%, 183 of 2737 codes). Hypersensitivity to cold, which has the symptom of feeling cold in the hands and feet more often than others, may be associated or correlated with infertility [49–51]. Previous studies suggest that traditional herbal medicine (e.g., Jusen-tai-ho-to) is effective in relieving this symptom [50,51]. The hypersensitivity to cold appears to be more frequent in Asian women than in Western populations [50]. In Japan, the prevalence of cold hyper-sensitivity in the hands among women has been reported as 54.3% [49]. Kampo including Jusen-tai-ho-to is a Japanese traditional medicine used to treat women's health issues and a leading alternative medicine [52,53]. The emphasis on hypersensitivity to cold and kampo in the magazine articles may, therefore, reflect the Asian predisposition and Japanese medical context.

We found that these fertility-related magazines place an emphasis on nutritional factors such as fatty foods, amino acids, and energy drinks. Namely, 18.67% (511 of 2737 codes) correspond to nutrition and diet, consumption of nutritional supplements, and caffeinated and non-caffeinated beverage intake. Although nutritional factors such as healthy dietary patterns are evidence-based lifestyle factors associated with fertility [13,39], they are covered in the articles to a greater extent than other factors. This is consistent with our findings from a previous study of online content [22]. A 2016 survey conducted in Japan reported that 59.7% of female respondents and 32.0% of male respondents reconsidered their dietary habits when pregnant or trying to conceive [15] consistent with the emphasis on nutrition we observed in the magazine articles. The reason for the large number of descriptions about nutrition and diet may reflect: (1) the magazine editors' association between health messages and cooking recipes as entertainment, and (2) the fact that magazines receive advertising revenue from companies that produce and sell nutritional supplements. As we mentioned, magazines are a major source of health information, especially for women [20]. Therefore, publishers of fertility-related magazines should consider providing balanced information to their readers.

Articles in fertility-related magazines were less focused on health check-ups (e.g., semen testing and ultrasound; 5.26%, 144 of 2737 codes) and more focused on factors such as nutrition and diet, psychological stress, and hypersensitivity to cold. A careful physical examination of both partners can uncover an etiology such as endometriosis and orient a therapeutic course [44]. The Japan Society of Obstetrics and Gynecology has recommended that women consult with an obstetrician prior to conception to ensure that they are healthy [35], a recommendation seconded by the Centers for Disease Control and Prevention [3]. Therefore, publishers of fertility-related magazines should consider placing more emphasis on health check-ups.

We found that lifestyle factors specific to women were more frequently cited than lifestyle factors specific to men. This may be because (1) men tend not to seek information about infertility [25], (2) historically, reproductive health tends to be conceptualized as the female body and women's issue [25]. Similarly, previous studies have shown that infertility tends to be viewed as a woman's issue in Japan [54]. It is possible that the editors of the magazine were also influenced by this social norm, which may have led to the description of more lifestyle factors specific to women than men. However, since half of the causes leading to infertility are attributable to men [55], magazine editors should include more descriptions of lifestyle factors specific to men.

In addition to the 10 evidence-based lifestyle factors associated with fertility, 66 other factors were described in the magazines to readers considering pregnancy. Although there were many recommendations in the magazine articles, many researchers in the healthcare context indicated that exposure to too much information can induce anxiety and a feeling of being overwhelmed [56,57]. In such situations, additional cognitive resources are required to understand the content, which can also affect the individual's health motivation and knowledge base [56]. Therefore, readers of the magazines analyzed in this study may have been confused by the large number of recommendations and felt anxious and overwhelmed. Therefore, publishers of fertility magazines should consider the order of priority for readers.

The articles we analyzed cited sleeping habits (e.g., lack of sleep, inability to sleep), use of aromatherapy oils (e.g., aromatic oils, essential oils), massage (e.g., foot massage, bowel massage), crossing the legs (e.g., distortion of the body from crossing the legs), and holding a bag (e.g., dispersion of the weight of luggage) as factors that affected fertility. To the best of our knowledge, no systematic reviews and meta-analyses, which are considered to have a high level of evidence, have assessed these factors in the context of fertility. A large body of research is also needed to ensure the accuracy of any associations between these factors and fertility. Currently, it is not possible to determine if there are associations between these factors and fertility. Therefore, it may be considered inaccurate for magazine editors to indicate to readers that there are associations. Inaccurate information leads to inaccurate perceptions [58]. That is, after reading inaccurate information, people give more inaccurate answers to questions than after reading accurate information [58]. Furthermore, people may rely on inaccurate information even when they have relevant prior knowledge [58]. This suggests that the magazine articles we analyzed may have instilled inaccurate perceptions in women attempting to conceive. Publishers should collaborate with experts to disseminate unambiguous and appropriate information on fertility and infertility that is evidence-based.

As mentioned above, the results of this study could serve as recommendations to magazine editors. In addition, understanding what information people who want to conceive but are not having infertility treatment are exposed to, and to what extent, may help healthcare providers to offer reliable sources of information or provide missing information in the medical context to new attendees at infertility clinics.

This study has several limitations. First, only Webcat Plus and Amazon were used to select magazines. Magazines published in Japan were listed by the Japan Magazine Advertising Association, but no magazines on fertility were listed [59]. The data analyzed in this study are considered to cover major magazines on fertility, but do not cover all fertility-related magazines. Second, we examined magazine articles in fertility-centered magazines but not from television, newspapers, books, or the internet. Third, the two magazines (issues from the first publication of 2014 to 2020) analyzed in this study did not encompass all the messages targeting those considering pregnancy who have not yet visited an infertility hospital or clinic. For example, although these two magazines were focused on fertility, other women's magazines may also have special sections on fertility. Therefore, these two magazines may not be representative of all Japanese fertility-related magazines and articles. Similarly, these two magazines were included in the analysis from the first publication (2014) to 2020, but not for the other periods. Fourth, we did not qualify the accuracy of the information. This was because there were more than 1000 associations

between the details of factors described in the magazine articles, which was inconsistent with the overall trend that this paper aimed to examine. This aspect should be examined in further studies. Fifth, the factors and categories discussed in this study were extracted inductively and comprehensively, but the appropriateness of each factor and category was not verified. Sixth, this study may have limited generalizability because the sources and cultural contexts were uniquely Japanese. However, local context should be considered when analyzing media messages [23], so the results of the present analysis are of value to some extent. Seventh, for all lifestyle factors tested in this study, we did not examine whether they are female-oriented or male-oriented. This is because many of the lifestyle factors listed in the magazine did not state whether they were specific to men or women. Despite these limitations, to the best of our knowledge, this study is the first to examine the information in fertility-related magazine articles on lifestyle factors.

## 5. Conclusions

This study quantitatively and inductively examined the lifestyle factors cited as associated with fertility in Japanese fertility-related magazines, and found some correlation with evidence-based lifestyle factors. However, these magazine articles appear to place a greater emphasis on nutrition than on other factors, raising the question of whether the information presented is unbalanced. In particular, publishers should place a greater emphasis on health check-ups to identify physiological causes of infertility. Sleeping habits, use of aromatherapy oils, and massage were also mentioned, although evidence linking these factors to fertility is ambiguous. Fertility-related health messages should offer evidence-based recommendations.

**Supplementary Materials:** The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/women3030031/s1>, Table S1: Lifestyle factors associated with reduced fertility; Table S2: Factors considered in the analysis.

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