"Effects of plant-based diets on a child's nutritional status: a small review"

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ABSTRACT

Objective: The objective of this work is to analyse the current articles that have studied the effects of a vegetarian diet on nutritional state in childhood and/or adolescence stage of life. The main purpose is to examine the relation between a vegetarian diet and intake of macro/micronutrients.

Methods: A research was conducted on the search engine, PubMed to select a total number of 11 articles (2014–2022) that analysed this topic.

Results: As three types of a vegetarian diet (Lacto-Ovo vegetarian, Vegan and Non-specified) were investigated in the selected articles, therefore, the results are also divided in three sections. The findings were similar in most of the studies. On the one hand, protein intake was on lower levels in the vegetarian groups. On the other hand, intakes of carbohydrates, fibre was on higher levels. The lipid intake differentiated in the type of fat as the vegetarian groups presented a lesser ingestion of saturated fats. The intake of different micronutrients presented only some minor differences.

Conclusions: A vegetarian diet does not have any significant negative impact on the nutritional status of a child. A well-planned vegetarian diet that includes every food group in right proportion can be adequate for a child without any drawbacks.

***Keywords**: Child/Children, Infant, Adolescents, Vegetarian, Vegan, Nutrients*

Sustainable Development Goals (SDGs)

The SDGs dealt with in this work, are the ones that affect basically two fields: People's health and the environment.

The SDG 3 "*Good Health and Well-Being*", urges us to prevent and combat diseases. It promotes a healthy lifestyle and physical activity. Therefore, from the evidence found through this work, it can be stated that adapting a vegetarian diet is a healthy diet. If followed correctly with the guide of a nutrition expert, it can have positive influence on our health.

However, being vegetarian not only affects us nutritionally, but it also leaves its print on our environment and the Earth. Although, this aspect related to environment is not studied in this work, it has been reported by several studies that the adaption of a vegetarian diet by a significant percentage of population may affect our environment. Therefore, we can also include the SDG 12 "*Responsible Consumption and Production*" and SDG 13 "*Climate Action*" as they cover the impact on the environment. Our eating habits leave a mark on the environment. To meet the increasing demands of meat products, cattle raising is increasing exponentially. A large part of forests is cut down to make farms for animals grazing. Moreover, the gas emissions (CO_2) and contamination produced by the factories negatively affects our surroundings. Thus, evidence suggests that following a vegetarian diet can be a small step towards putting a break to deforestation and gas emissions. It can slow down the process of climate change.

RESUMEN

Objetivo: El objetivo de este trabajo es analizar los artículos recientes que han estudiado los efectos de una dieta vegetariana sobre el estado nutricional en la etapa de la infancia y/o adolescencia. El propósito principal es examinar la relación entre una dieta vegetariana y la ingesta de macro/micronutrientes.

Métodos: Se realizó una investigación en el buscador PubMed para seleccionar un total de 11 artículos (2014-2022) que analizaran este tema.

Resultados: Como se investigaron tres tipos de dieta vegetariana (Lacto-Ovo vegetariana, Vegana y No especificada) en los artículos seleccionados, por lo tanto, los resultados también se dividen en tres secciones. Los hallazgos fueron similares en la mayoría de los estudios. Por un lado, la ingesta de proteínas fue menor en los grupos vegetarianos. Por otro lado, la ingesta de carbohidratos, la fibra estaba en el lado más alto. La ingesta de lípidos se diferenció en el tipo de grasa ya que los grupos vegetarianos presentaron una menor ingesta de grasas saturadas. Únicamente en la ingesta de diferentes micronutrientes se detectaron algunas diferencias menores.

Conclusiones: Una dieta vegetariana no tiene un impacto negativo significativo en el estado nutricional de un niño. Una dieta vegetariana bien planificada que incluya todos los grupos de alimentos en la proporción adecuada puede ser adecuada para un niño sin presentar ningún inconveniente.

***Palabras clave**: Niño/Niños, Lactante, Adolescentes, Vegetariano, Vegano, Nutrientes*

Objetivos de Desarrollo Sostenible (ODS)

Los ODS tratados en este TFG son los que afectan básicamente a dos campos: la salud de las personas y el medio ambiente.

El ODS 3 “Salud y Bienestar”, nos insta a prevenir y combatir las enfermedades. Promueve un estilo de vida saludable y la actividad física. Por lo tanto, a partir de las evidencias encontradas a través de este trabajo, se puede afirmar que adaptar una dieta vegetariana es una dieta saludable. Si se sigue correctamente con la guía de un experto en nutrición, puede tener una influencia positiva en nuestra salud.

Sin embargo, ser vegetariano no solo nos afecta nutricionalmente, sino que también deja su huella en nuestro entorno y en la Tierra. Aunque este aspecto relacionado con el medio ambiente no se estudia en este trabajo, varios estudios han informado que la adaptación de una dieta vegetariana por parte de un porcentaje significativo de la población puede afectar nuestro medio ambiente. Por lo tanto, también podemos incluir el ODS 12 “Producción y consumo responsables” y el ODS 13 “Acción por el clima” ya que cubren el impacto en el medio ambiente. Nuestros hábitos alimenticios dejan huella en el medio ambiente. Para satisfacer la creciente demanda de productos cárnicos, la ganadería está aumentando exponencialmente. Se tala una gran parte de los bosques para hacer granjas para el pastoreo de animales. Además, las emisiones de gases (CO_2) y la contaminación que producen las fábricas repercuten negativamente en nuestro entorno. Por lo tanto, la evidencia sugiere que seguir una dieta vegetariana puede ser un pequeño paso para frenar la deforestación y las emisiones de gases. Puede ralentizar el proceso del cambio climático.

1 Introduction

If we look into the pages of history books, we will find that early humans based their diets mainly on plants. One of the most important reasons that could be stated was the accessibility to find vegetables and plants. In the early periods of history, hunting animals was thought to be a challenging task, for this reason it was much easier to find edible plants and vegetables.

Over the years and centuries, plant-based diets were promoted by different sectors. In the middle age, religions had a strong hold on people's life and some religions such as Buddhism and Hinduism endorsed the vegetarian/plant-based diet. Moreover, various important personalities such as Greek philosophers also opted for this diet that further influenced people on following it (1).

Even though, plant-based diets have always been part of humankind, there were some prejudices against it. However, in the 21st century, thanks to the scientific studies carried on this subject, those prejudices started to be rejected. In fact, these diets evidenced to provide protection against some contemporary diseases (1).

Nowadays, tendency to follow plant-based diets is growing exponentially and it is being accepted worldwide. This inclination towards this diet is supported by distinct reasons such as: intellectual (ethical, moral, religious, spiritual), social (ecologic, economic, political) and physical ones (health, hygiene, toxicology, physical performance) (1).

Due to the increasing demand, the manufacturers and companies have started elaborating various products suitable for this diet. For example, if we go to the market now, a whole section of products related to this diet can be found easily. In consequence, following it has become relatively easy and accessible to everyone.

During the last decades, this phenomenon has been growing rapidly particularly among the young generation (2). In consequence, little by little, more young people are following plant-based diets and therefore it can be predicted that this diet would also be chosen as the diet for their future children. For this reason, it is fundamental to carry out enough studies to see and define the effects of a vegetarian diet during infancy, childhood, or adolescence.

It is a well-known fact that young children need high nutritional requirements to have a proper growth and development. Also, there is no doubt that a considerable number of studies about plant-based diets and its effects have been done. However, most of them have been focused on adult population. Therefore, results cannot be extrapolated directly to the infants or teenagers.

This topic is extraordinarily broad as the effects of a vegetarian diet on a child's health can be analysed from different perspectives. Considering this fact, the present review will mainly focus on the relation between a plant-based diet and nutrients (macro/micronutrients). The current evidence will be investigated to evaluate how following this specific kind of diet can affect the nutrients levels in children.

1.1 Objective

The aim of this work is to study the current evidence that exists on this topic. The main objective is to know the effects of a plant-based diet on nutritional state in childhood and/or adolescence stage of life. The relation between a vegetarian diet and nutrients will be assessed.

1.2 Methodology

This work classifies as bibliographic research. The research has been done by consulting the scientific articles that are integrated in the search engine, PubMed, provided by University of Barcelona. Consulted articles are open access ones and/or magazines that allow the access through UB registration.

The search on PubMed has been done using keywords such as:

- Vegetarian OR Vegan AND Infant OR Childhood
- Vegetarian OR Vegan AND Adolescence

At first, during the selection of articles, a filter of 10 years (2012-2022) was applied, in order to permit the revision of current scientific articles.

A systematic review of *S. Schürmann et al*. was published in 2017. In this one: a total number of 24 articles, published from 1988 to 2013, were screened and 16 studies were selected to be reviewed in detail. As this review covers a quite large period, it considered as a reference in the field, as well as a reference point for the present work (3).

The main task was to find studies published after that period. After having a reference point to look up to, almost the same inclusion/exclusion criteria were applied for this systematic review.

Inclusion criteria:

- Time period: 2014-2022.
- Observational or clinical studies
- Age: 0-18 years.

Exclusion criteria:

- Studies on special periods such as pregnancy, lactation etc.
- Case reports, reviews, position statements, guidelines, etc.
- Studies in non-industrialized countries.
- Studies in macrobiotic diets.

After scanning articles by reading their titles and abstracts, finally a total of 11 articles were selected to be examined for this work.

2 Types of plant-based diets

During the years, this diet has evolved, and different varieties are now integrated in society. An evident common feature is the exclusion of meat from the diet; however, major differences can be observed among them. They have been classified into distinct categories.

2.1 Vegetarian

This is the main group of a plant-based diet. It consists of excluding the consumption of meat of different source (beef, poultry, fish, pork etc) and other animal products. For this reason, products based on plants such as fruits, vegetables, grains, legumes, seeds, nuts become the main standards in this dietary pattern (4). This group can be divided into two subcategories.

2.1.1 Lacto-ovo-vegetarian

This subgroup of a vegetarian diet excludes the consumption of meat, fish, poultry, pork. However, it allows milk, dairy products (cheese, butter, yogurt etc) and eggs. This subgroup can be further split in two variations**: Lacto-vegetarian** that includes dairy products, excludes eggs, and eggs products (4) and **Ovo-vegetarian** that includes eggs and excludes dairy products (4).

2.1.2 Vegan

This variant is also known as strict vegetarian. It prohibits the consumption of any animal product. It excludes meat, poultry, fish, pork, eggs, dairy products, gelatine, honey, and any additive that is derived from an animal (4).

These are the main groups of plant-based diets that are being followed by most people. The differences among each group can be observed in **Table 1**.

Table 1: Difference among different types of a vegetarian diet.

	Lacto-Ovo vegetarian	Lacto-vegetarian	Ovo-vegetarian	Vegan or strict vegetarian
Dairy products	YES	YES	NO	NO
Meat	NO	NO	NO	NO
Eggs	YES	NO	YES	NO

3 Results and discussion

To understand the effects of a vegetarian diet on children, different variables can be observed. Following a vegetarian diet functioned as a constant in all those studies, however, distinct parameters were analysed in each study.

The principal factors analysed are as following:

1) Total Intake of energy (kcal)
2) Macronutrients Intake (Protein, Carbohydrate, Lipid, Fibre)
3) Micronutrients Intake
    - Vitamins: A, B, C, D, E
    - Minerals: Fe, Ca, Na, K, P, Mg, Zn

Selected articles have based their findings on specific variations of vegetarian diets; however, some articles do not specify the specific kind of variation. Some of them are more focused on Lacto-ovo-vegetarian or a vegan diet. Therefore, it is necessary to divide the results of these studies in three sections according to the type of diet mentioned in the article.

In each section, a combined summary of results from different studies is explained.

3.1 Lacto-Ovo-vegetarian diet

This specific version of a vegetarian has been the most studied one in the selected articles. The results that can be extracted are:

3.1.1 Total intake of energy (kcal)

According to the results of most studies, there was a clear indication that the total energy (measured in form of kcal) did not present any significant difference among the Lacto-ovo-vegetarian group and the Omnivorous group (5-10).

However, a study that tracked dietary patterns for 20 years (from childhood to adolescence of subjects) found out that there was a noticeable difference between the two groups. It was stated that the kcal consumed by the Lacto-ovo group was significantly lower than the energy intake of the omnivorous group. The method applied by this study was a bit unconventional. It consisted of comparing characteristics of participants across two extreme quartiles for each dietary pattern (Lacto-ovo or omnivorous) during childhood, adolescence, and adulthood (11).

After considering all the factors, it can be concluded that there is no significant difference and the energy intake of two dietary groups is almost identical.

3.1.2 Macronutrients Intake

Carbohydrates: six studies confirmed that the intake of carbohydrates was higher in the Lacto-ovo vegetarian group (5-10).

Lipids (also known as fats): Regarding this nutrient, there was a difference found among different studies. On the one hand, a study found that the intake of fats was just slightly higher in the vegetarian group (5). On the other hand, according to some studies, fat consumption was lower in Lacto-ovo diets (6-7, 9-10). Meanwhile, an article also stated that the quantity of fat consumed by both groups was similar (8).

Protein: The consumption of protein by the lacto-ovo vegetarian group was found to be in less quantity than the omnivorous group. (5-10).

Fibre: Its consumption is higher in the Lacto-ovo vegetarian group (5-6, 9-10).

Even though the vegetarian diet may have presented some small difference from the omnivorous diet, the point to note here is that the values of those macronutrients were still found in the normal range or interval established by the respective authorities.

3.1.3 Micronutrients Intake

An important part of the micronutrients is essential for the proper growth and development of children, particularly in their early years. It is necessary to have a balanced diet that meets the high nutritional requirements of a child. Micronutrients can be divided into two group:

- Minerals:

Iron (Fe): According to studies, the iron consumption was higher in the vegetarian group (6-7).

In the case of iron, not only a vegetarian/non-vegetarian separation is needed but also a gender segmentation is assumed as crucial, since this nutrient is of particular interest in the female population.

If we go through the recommendations given by *"Federación Española de Sociedades de Nutrición, Alimentación y Dietética (FESNAD),"* we observe that the recommended intake is higher for females than males. For an adult male, the recommended value stands at 9 mg/day, meanwhile for an adult female, the value is double (18 mg/day) (12).

In case of children and/or adolescents, the value does not present a significant difference among the two genders. From new-born to the first 9 years, the recommended intake is similar among the two populations. After that age, it is higher for females (12). The main reason for this recommendation is due to the menstrual cycle of females since high quantities of iron are lost through blood during period. Therefore, to compensate this loss, a higher intake is advised. However, according to the conclusion drawn by a study, the average iron intake was lower in females than in boys (13). That comparison was done without dividing them in vegetarian and non-vegetarian groups.

The difference between vegetarian male population and non-vegetarian male was not examined. But as stated before, this nutrient is an interesting aspect while analysing the female population. Therefore, this aspect was studied. As shown in **Figure 1**, the average intake of total iron was slightly higher in vegetarian females (13).

Nowadays, main source of iron for the general population is through meat products. Even though iron is also found in many plant-based products, meat is still considered as the primary source. It can be explained by the fact that iron is found in two different forms. As quoted in article by *Skolmowska D et al*:

"iron is present in food products in two forms, as heme iron, which is found in meat and other animal products, and as non-heme iron, which is found in both plant and animal products [12], that differ in their chemical form, absorption processes, and uptake mechanisms [13]. Heme iron is highly bioavailable (25–30% of this form is absorbed), although it represents a minor part of dietary iron [14,15], while the absorption of non-heme iron is more variable (1–10% of this form is absorbed) (13).

In the same article, it was studied how the iron comes from various sources in the particular group (**Figure 1**). Female vegetarians consume more non-heme iron that was found in plant products. This leads to an important question. As seen in **Figure 1**, the difference between the intakes of the two groups is not that significant. However, if the non-heme iron absorbs in lesser quantity, is it necessary to increase the recommended value of iron for vegetarian groups? Further studies are needed to investigate this aspect.

Calcium: The intake was almost similar in both groups. In one article, it was said to be slightly higher in the Lacto-ovo vegetarian group (6). Meanwhile, in another article, it was on the lower side in the vegetarian group (9). Still, the difference was not significant.

Sodium: The consumption was higher in the Lacto-ovo-vegetarian group (6).

Potassium: Its intake was higher in the Lacto-ovo-vegetarian group (6).

Phosphorus: The intake value was almost similar, although slightly lower in the vegetarian group (9).

Magnesium: It was found to be higher in the vegetarian group (6, 9).

Zinc: It was moderately lower in the Lacto-ovo-vegetarian group (6).

Table 6. Comparison of the intake of various forms of iron along with that of iron intake from various sources in the national sample of Polish female adolescents, in the sub-groups of vegetarian and non-vegetarian female respondents.

Intake of Iron		Vegetarian Female Respondents (n = 85)			Non-Vegetarian Female Respondents (n = 1300)			p-Value **
		Intake (%)	Mean ± SD	Median (25th–75th)	Intake (%)	Mean ± SD	Median (25th–75th)	
Intake of various forms of iron	Total iron (mg)	100	13.96 ± 7.87	12.31 (8.10–18.76) *	100	12.70 ± 7.01	10.98 (7.85–15.60) *	0.186
	Heme-iron (mg)	5.1	0.71 ± 1.06	0.42 (0.25–0.70) *	13.8	1.75 ± 1.54	1.22 (0.76–2.19) *	<0.001
	Non-heme iron (mg)	94.9	13.25 ± 7.59	11.43 (7.40–17.38) *	86.2	10.96 ± 5.92	9.57 (6.80–13.47) *	0.007
	Animal iron (mg)	12.7	1.77 ± 2.64	1.06 (0.63–1.76) *	34.4	4.37 ± 3.84	3.06 (1.89–5.47) *	<0.001
	Plant iron (mg)	87.3	12.19 ± 7.43	10.62 (6.82–15.46) *	65.6	8.33 ± 4.77	7.32 (5.04–10.34) *	<0.001
Intake of iron from various sources	Cereals (mg)	30.7	4.28 ± 3.19	3.35 (2.03–4.47) *	27.7	3.52 ± 2.19	3.04 (2.03–4.47) *	0.023
	Meat products (mg)	6.6	0.92 ± 2.45	0.00 (0.00–0.42) *	27.2	3.46 ± 3.62	2.17 (1.09–4.42) *	<0.001
	Vegetables (mg)	31.5	4.39 ± 3.41	3.23 (1.60–6.54) *	16.3	2.08 ± 1.84	1.60 (0.79–2.73) *	<0.001
	Nuts (mg)	10.7	1.50 ± 1.64	0.91 (0.18–2.26) *	7.9	1.00 ± 1.37	0.55 (0.00–1.45) *	0.004
	Fruit (mg)	7.3	1.02 ± 1.07	0.65 (0.37–1.13) *	5.5	0.70 ± 0.60	0.56 (0.28–0.92) *	0.014
	Cocoa products (mg)	3.7	0.51 ± 0.58	0.36 (0.14–0.75) *	4.1	0.53 ± 0.56	0.36 (0.18–0.67) *	0.783
	Eggs (mg)	3.6	0.50 ± 0.49	0.47 (0.16–0.63) *	4.1	0.53 ± 0.50	0.47 (0.31–0.63) *	0.281
	Potatoes (mg)	2.5	0.35 ± 0.46	0.21 (0.14–0.43) *	2.9	0.37 ± 0.35	0.29 (0.21–0.43) *	0.022
	Dairy products (mg)	2.2	0.31 ± 0.24	0.24 (0.13–0.47) *	2.1	0.27 ± 0.19	0.24 (0.15–0.35) *	0.469
	Fat (mg)	0.9	0.13 ± 0.13	0.09 (0.06–0.17) *	1.0	0.14 ± 0.13	0.11 (0.06–0.17) *	0.378
	Fish products (mg)	0.4	0.05 ± 0.09	0.00 (0.00–0.06) *	1.0	0.11 ± 0.16	0.06 (0.00–0.13) *	<0.001

FIGURE 1: *Comparison of iron intake from various sources among vegetarian and non-vegetarian groups, extracted from reference (13).*

- Vitamins

Regarding the vitamins group, studies found the intake of Vitamin A, C and E was higher in the Lacto-ovo-vegetarian group (6, 7). The consumption of Vitamin D was stated to be similar in both groups (6, 8). Meanwhile it was confirmed by various studies that the different types of Vitamin B were consumed in almost similar quantities by the two groups (6, 7). The only exception was Thiamine (Vitamin B1) that was higher in the vegetarian group (6).

Vitamin B12 is regarded as a critical nutrient for vegetarians and vegans. Its main source is animal products and therefore, vegetarians may need supplements to fulfil B12 recommended levels. However, one study discovered that the intake was similar in the two groups (6) while, according to another one; it was significantly lower than in the omnivorous diet group (8).

3.2 Vegan Diet

This specific version of a vegetarian diet is the strictest one. It excludes all kind of animal product including milk and eggs. From the selected articles, only two articles analysed the effects of this diet on children in detail.

Below is a summary of the obtained results:

3.2.1 Total intake of energy (kcal)

According to the selected articles, the kcal consumed by the vegan group did not differ much from the omnivorous group (5, 14).

A study conducted in Finland, analysed the nutritional status of 40 daycare children following omnivore and vegan diet. As seen in **Figure 2**, the energy intake is similar in the three groups examined (14).

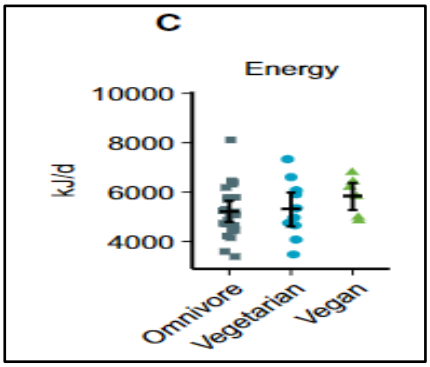

***FIGURE 2**: Energy Intake*

3.2.2 Macronutrients Intake

Carbohydrates: The intake of Carbohydrates was nearly identical in the vegan group and omnivorous group (5).

Lipids: As shown in **Figure 3**, the ingestion of lipids in the vegan group was similar to the omnivorous group (5, 14). Nonetheless, a clear difference was observed in the intake of saturated fat acids, vegan children registered lower quantities of ingestion of

saturated fat acids (**Figure 3**) (14). The absence of dairy products, meat could explain that point to some extent.

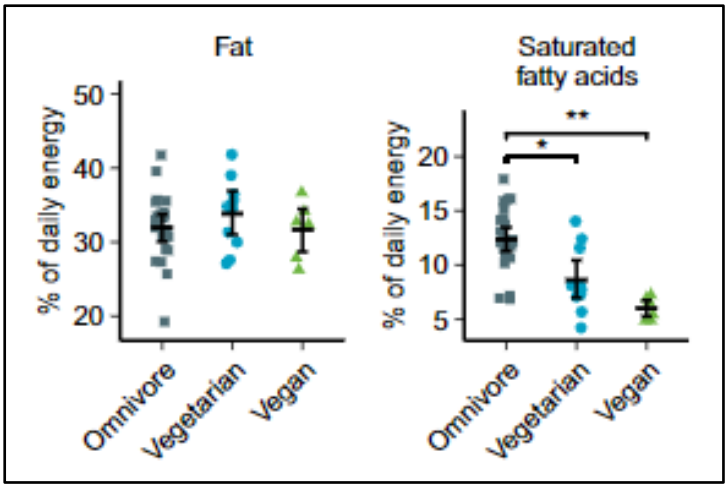

***FIGURE 3**: Comparison of fat intake between omnivore and vegan diet.* [1]

Protein: The intake level of proteins in the vegan children showed some slight difference from the omnivorous group. It happened to be on the lower side in vegan children (**Figure 4**) (5, 14).

Fibre: Its intake was higher in the vegan group as compared to the omnivorous diet group (5, 14).

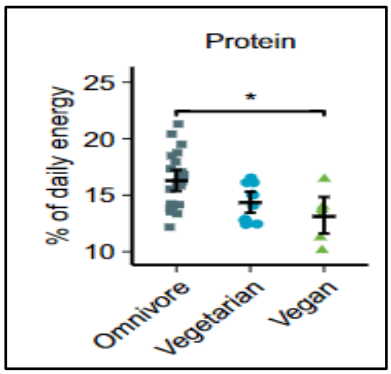

***FIGURE 4**: Protein Intake*

3.2.3 Micronutrients Intake

As a vegan diet restricts many more food groups than the Lacto-ovo-vegetarian diet, therefore, it is even more important to evaluate whether vegan children present any deficiencies of nutrients. However, the selected studies do not have the data for every mineral analysed in this work.

- Minerals

The study conducted by *Hovinen T et al*, explored the difference of two minerals intake, Iron and Zinc between the vegan and the omnivorous group. As it can be seen in **Figures 5** and **6**, the intake of iron and zinc of the vegan group was found out to be higher than the omnivorous one (14). As the study does not contemplate the rest of the minerals therefore, further investigation is needed to see how following a vegan diet affects those minerals.

[1] The first graph shows the difference of total fat intake among the different groups. Meanwhile, the second graph analyses the intake of saturated fat among the three diet groups.

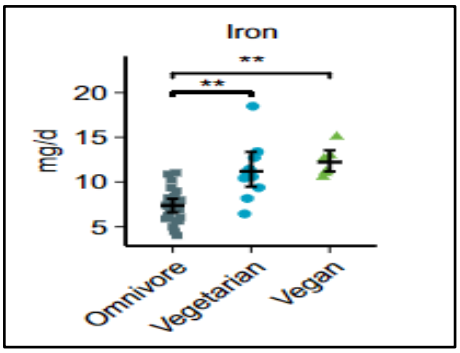

***FIGURE 5**: Iron Intake*

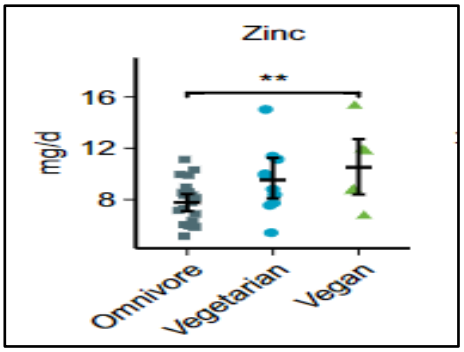

***FIGURE 6**: Zinc Intake*

- Vitamins

In the case of vitamins, the selected article does not thoroughly study all vitamins. Only the intake of Vitamin A, D, Folate (B9) is investigated.

According to the extracted results, the intake of Vitamin A and Vitamin D (**Figure 7**) was similar in the vegan and omnivorous diet group. The article also clearly mentioned that most of the children were taking supplements of Vitamin D.

In this case, no major differences were found in the intake of Vitamin B12 between the two groups (14).

The Vitamin B9, also known as Folate, presented significant higher levels in the vegan group (**Figure 7**) (14).

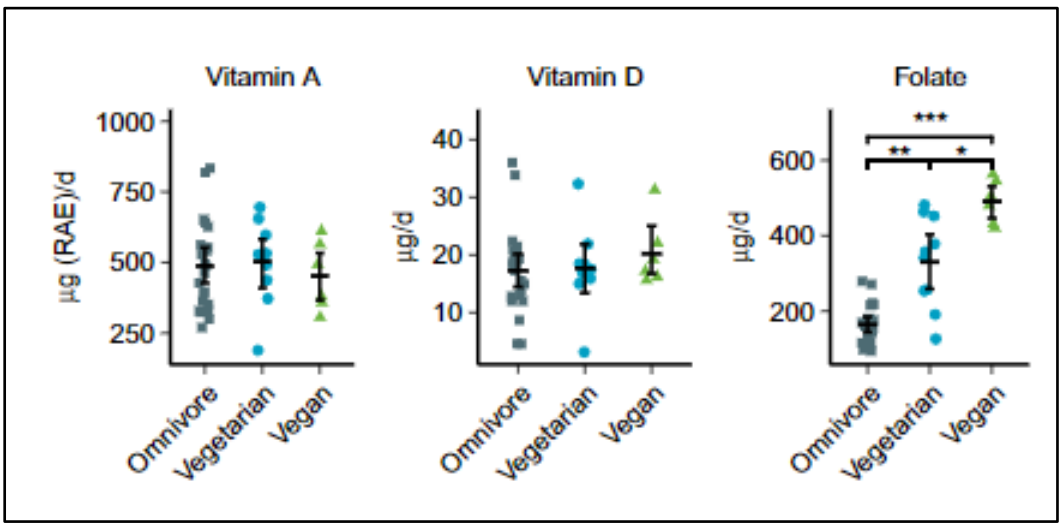

***FIGURE 7**: Comparison of vitamins intake between the omnivore and the vegan group.* [2]

[2] The figure illustrates 3 graphs. Each graph compares the Intake of a specific Vitamin among three diet groups (omnivore, vegetarian, vegan). The Vitamins represented are Vitamin A, D and B9 and the graphs 1, 2 and 3, respectively.

3.3 Vegetarian Diet without specification

Some of the selected articles did not classify the participants according to the lacto-ovo or vegan diet group. Therefore, the results were perceived as a vegetarian group in general. As the exact nature of vegetarian type is not mentioned, therefore, it is important to study these articles separately. They will be called “Not-specified vegetarian group.” The relevant findings are summarised below:

3.3.1 Total intake of energy (kcal)

There was no relation between the two variables. That is an indication that following a vegetarian diet does not change the energy intake significantly. Thus, the energy intake of a vegetarian group is approximately equal to that of an omnivorous group (15).

3.3.2 Macronutrients and micronutrients Intake

From this section, no strong correlations were found amongst any of the nutrients and the vegetarian diet except of the following:

Protein: This nutrient showed an inferior intake in the vegetarian group (15).

Zinc: according to the results, a vegetarian diet meant lower intake of zinc (15, 16).

Vitamin B3 (niacin): It was found to be lower in the vegetarian group (15).

4 Conclusion

After consulting and studying thoroughly all the articles, the main conclusion that can be drawn is that there is not major difference found between the nutritional status of a vegetarian and a non-vegetarian diet. Undeniably, the evidence suggests the existence of some minor difference among the intake of some nutrients. Most of the studies deduced that the intake of protein is slightly lower in the vegetarians’ groups. An interesting point was that the lipid ingestion was almost like the omnivorous groups but with a lower saturated fat intake. It points out to the possibility of vegetarian children presenting a better lipid status. Although, the values of vitamins and minerals analysed may slightly differ in vegetarian and omnivorous group, the difference is not that pronounced.

The review by *S Schürmann et al*, that has been used as a reference point for this work, didn’t conclude any results. The reason stated was the insufficiency of data due to small number of studies done. In that review, 16 studies were analysed from 1988 to 2013 which can be considered an almost insignificant number considering the time

involved (3). However, the research on this specific field is increasing exponentially as more people are adapting it as their dietary habits. For the current work, 11 articles were analysed from the period of 2014-2022. Therefore, it shows that this field is becoming more popular among the scientific community. Nevertheless, further studies are required that examine the effects of a vegetarian diet from different aspects. As there are several types of a vegetarian diet so each one should be analysed separately from different perspectives like metabolism, gene expression, immunology, inflammation, chronic diseases etc. Moreover, it is extremely important to study whether a vegetarian child presents any side-effects once he/she reaches to the adult life. For now, it can be claimed that a vegetarian diet does not negatively affect the nutritional status of a child, nor does it hinder his/her growth. The only condition is that the vegetarian diet must be well-planned so that the nutritional needs are fulfilled adequately (17).

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