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Health Effects of Consuming Vegetables Grown in the Presence of Salt: A Systematic Review

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Abstract

In arid and semi-arid areas, salinity problems are common due to several factors. In Africa, salinity and alkalinity affect 24% of the continent's arid and semi-arid areas and about 30% of the African population depends on these lands. This salinity is not without consequences for crops. The objective of this systematic review is to update research knowledge on the effects of salt stress on vegetables and consumers. To achieve this, several searches were conducted in four search engines and bibliographic databases of electronic scientific journals (PubMed, African Journal Online, Google scholar and Cochrane). The PICO-based research question for this synthesis was: In rats consuming mutant or non-mutant vegetables grown in the presence of salt, does the consumption of mutant or non-mutant vegetables grown in the presence of salt have an impact on the health of consumers? A total of 321 articles were available in the scientific journals explored, only three addressed the effect on nutritional aspects and none of them addressed the health effects of vegetables grown in the presence of salt. The results of these interventions revealed that salt stress altered the nutritional profile of the plants explored. This alteration was reflected in variations in vitamin and mineral content. Moreover, salt stress could also alter the number of fruits on the plants. This systematic review will therefore contribute to the implementation of research on the impact of the consumption of vegetables grown in the presence of salt on the health of consumers.

Keywords

Consumption, Vegetables, Salt Stress, Health

1. Introduction

In arid and semi-arid areas, salinity problems are common due to several factors. In Africa, salinity and alkalinity affect 24% of the continent's arid and semi-arid areas [1] and about 30% of the African population depends on these lands [2]. Salinized irrigated land accounts for about 10% and nearly 50% of this land is found in arid areas [3].

Soil salinization is a concern worldwide. According to Pérez, globally, about one third of cultivated land is affected by salinity [4]. This situation could thus lead to a global catastrophe. Salinization is not without enormous consequences for food crops. It causes an increase in oncotic pressure which makes water difficult to mobilize by plants, a toxicity of certain ions for plants, in particular Cl^- and Na^+ ions [3]. The salt concentration in plant tissues increases as water is lost during the transpiration process [5]. On the other hand, salinization also negatively affects plant growth, reduces land yield, and can make soils unproductive [3] [6]. In the coastal countries of West Africa, in addition to cereal crops, the cultivation of vegetables plays an important role in agriculture to meet the needs of the population. However, the severity of the alteration of the quality of vegetables by salt also depends on the species and cultivar [7] [8]. The objective of this paper is to review the results obtained on the health of rats from different experiments on the consumption of vegetables or mutants of vegetables grown under salt stress.

2. Methods

2.1. Data Sources

Literature searches were conducted in the online databases of: PubMed, Google scholar, Cochrane and African Journal Online (**Table 1**). The articles selected were those published in English or French between 2011 and 2021. Different papers were also considered by exploiting the dissertations and theses produced in Benin, in particular those from the University of AbomeyCalavi. The research ended on December 31, 2021. The research question was formulated according to the PICO criteria (P = population, I = intervention, C = comparison group and O = results) (**Table 2**).

Table 1. Search equations used in the different databases.

Databases	Research question
Pubmed	("health effects" AND cunsumption AND vegetables OR "vegetable mutants" AND "salt stress") AND (y_10[Filter])
Google scholar	Health effects of eating vegetables grown under salt stress
Cochrane	"Salt stress" AND vegetables AND health in Abstract
African journal online	"health effects" AND cunsumption AND vegetables OR "vegetable mutants" AND "salt stress"

Table 2. Research question formulated according to the PICO criteria.

Research Question: Does the consumption of vegetables or vegetable mutants grown in the presence of salt stress have an impact on health in rats?	
P	Rats consuming mutants or not of vegetables grown under salt stress
I	Consumption of vegetables or vegetable mutants grown under salt stress
C	Control rats not consuming mutants or not consuming vegetables grown under salt stress
O	Alteration or not of health

2.2. Selection of Studies

The original studies related to the effect of consumption of vegetables or vegetable mutants grown under salt stress were those that should be included according to the selection criteria. The selection of studies from the electronic databases was done by the authors (AG and SE) in isolation. No discrepancies were observed.

2.3. Data Extraction

The information collected depends on the type of study, the population, the duration of the intervention and the results obtained.

3. Main Results

Figure 1 presents the literature search process. The initial selection of studies was 436, of which 109 were excluded as duplicates. After analyzing the titles of the articles, 323 articles had titles that were not relevant to the topic of this review. However, three articles addressed the nutritional aspects of vegetables grown under salt stress but none of the articles addressed the health effect of consuming these vegetables (**Figure 1**).

4. Discussion

Based on the literature search, there are no articles that have discussed the health effect of consuming vegetables grown under salt stress or articles that have discussed the health effect of consuming mutants of vegetables grown under salt stress.

Studies that have addressed the nutritional aspects of vegetables grown under salt stress have presented beneficial results reported in **Table 3** [8] [9] [10]. However, these studies did not focus on the analysis of all the nutrients of these vegetables. Therefore, it is difficult to rule on the precise impact of salt stress on nutritional quality and in turn on the correlation between the consumption of vegetables grown under salt stress and the alteration or not of health status. It is therefore important, even if benefits seem to exist, to investigate whether there are any drawbacks before recommending their consumption.

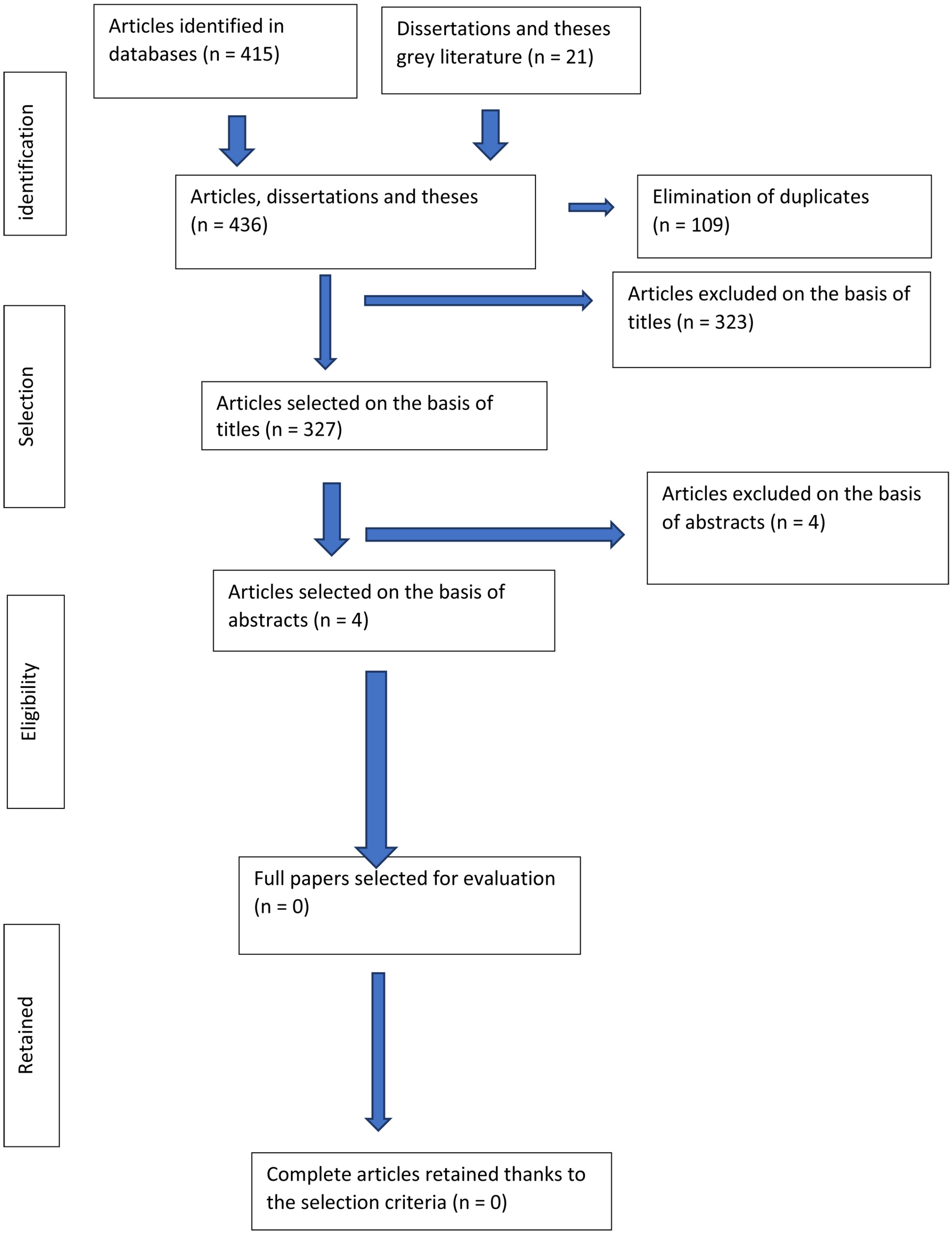

Figure 1. Summary of selected studies.

5. Conclusion

The present literature review reveals that salt stress could have a beneficial effect on the levels of some B-complex vitamins and iron content. However, the current literature does not contain available information on the effect of salinity on the complete nutritional values of vegetables and sodium levels have not been measured, let alone the effect of consumption of these vegetables on arterial

Table 3. Status of studies that addressed nutritional quality.

Studies and years	Country of realization	Study population	Intervention	Results
Karoune *et al.*	Algeria	Acacia	Salt stress at 50, 100, 200 and 300 mM NaCl after maturity	- Decrease in plant length with increasing concentration - significant decrease in root weight in the presence of salt stress - Decrease in water content from 200 mM - increase in Na content in proportion to the increase in salt stress - Increase in K content with salt stress and stabilization between 200 mM and 300 mM
Kinsou *et al.*	Benin	Tomato	Salt stress at 30, 60 and 120 mM NaCl on young plants until physiological maturity	- increase in the time of appearance of the first flowers - increase in the time to first fruits - reduction of the number of fruits per plant - reduction of the sugar content (total and reducing) from 30 mM NaCl - reduction of the fresh mass of the fruits from 30 mM NaCl - Increase in vitamin B6 and B12 levels with salt stress
Wouyou *et al.*	Benin	Amaranth	Salt stress at 30 and 90 mM NaCl on local pigweed plants for 4 weeks until physiological maturity	- increase in vitamins A, B1 and B2 - increase in iron content with salt stress - No statistically significant change in vitamins B3 and C, Potassium and Calcium.

health. Further research is needed to investigate the mineral content, especially sodium chloride.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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