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RESEARCH ARTICLE

A SYSTEMATIC REVIEW OF NUTRITOIN'S IMPACT ON ASTHMA PREVENTION AND MANAGEMENT

Dr. Tahani Mohammadali Bakhsh[1], Dr. Mazen Abdulwahab Yousef[2], Dr. Abdulazez Ibrahim Rahmani[2], Dr. Muath Jamaan Al Ghamdi[2], Dr. Rubuah Mohammed Ayyashi[2], Dr. Sama Ali Halawi[2], Dr. Abdullah Jamaan Alghamdi[2], Dr. Waleed Khalid Bahader[2], Dr. Mohammed Abdulaziz Haider[2], Dr. Lujain Ahmed Faraj[2], Dr. Nashwa Nasser Alsaeedi[2], Dr. Mahmood Mohammad Alqurashi[2], Dr. Saleh Abdullah Aloufi[2] and RN. Abdullah Muaidh Alreshidi[3]

1. Consultant Preventive Medicine and Public Health-Jeddah Health Directorate, KSA.
2. Service Doctor, MD, KSA.
3. Specialist Nursing, KSA.

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Abstract

Introduction: Asthma is a chronic respiratory disorder characterized by airway inflammation and hyperreactivity. Prevalence has continued to climb in recent decades as Western food habits have become more popular.

Methods: We searched PubMed, Embase, and Scopus (January 2000--October 2022) for randomized clinical trials that evaluated the effects of diet in adults with asthma.

Results: Among the 12,215 studies that were searched, only 12 were included. Obese people with asthma may benefit from a drop in weight of at least 7.5% from baseline due to calorie restriction. The influence of a diet high in items with putative antioxidant effect on asthma management was small and not clinically significant. Antioxidant supplements studies have shown positive results, with magnesium supplementation improving asthma management and vitamin C supplementation slowing the decrease of lung function. Studies on the impact of fatty acid supplementation on weight reduction, asthma management, and lung function all showed positive results. Propolis and caffeine have been shown to significantly improve lung function in clinical trials. But the opposite was found in research on high salt diets and lung function reductions.

Conclusions: For individuals who are overweight and suffer from asthma, the optimal dietary strategy seems to be calorie restriction rather than focusing on individual food groups.

Introduction:-

Asthma is a chronic condition characterized by episodes of airflow restriction due to airway inflammation and narrowing. Wheezing, coughing, chest tightness, and shortness of breath are common symptoms during acute bouts [1].

Corresponding Author:- Dr. Tahani Mohammadali Bakhsh
Address:- Consultant Preventive Medicine and Public Health-Jeddah Health Directorate, KSA.

Since the 1980s, the number of people affected with asthma has increased annually. In 1980, an estimated 6.8 million Americans suffered with asthma, according to statistics from the Centers for Disease Control's nationwide surveillance program [1]. In 2010, there were 25.7 million new cases reported [1]. In 1980, it was estimated that 3.5% of children suffered from asthma [1].As of 30 years later, 9.5% of children aged 0-17 were affected [1-2].A tragic outcome is possible with this illness. Deaths from asthma were the primary cause of illness in 1.9% of adults and 0.3% of children in 2009 [1]. People over the age of 65 had the greatest mortality rate from asthma [2].

In 2010, African Americans (11.9 percent) were more likely than white Americans (7.8 percent) to have the condition [1-2]. In addition, African Americans had a greater rate of death from asthma in 2010 (24.9% vs. 8.4%) than white people [1]. This was reported by both the National Vital Statistics System and the National Health Interview Survey in 2012. The frequency of asthma was greater among those whose families earned less than the federal poverty line [1,3]. People whose families earned less than 20% of the federal poverty level had a 2.5% greater asthma prevalence in 2010 than those whose families earned 100% or more of the poverty level [1]. According to Holsey et al. [4], racial and ethnic differences in asthma prevalence and mortality may reflect differences in health status and access to care. Uninsured or underinsured minorities are disproportionately disadvantaged when it comes to accessing and paying for high-quality medical care and pharmaceuticals. Also, minorities and the economically disadvantaged have a harder time getting appointments and are less likely to be seen by an asthma expert. People from lower socioeconomic backgrounds tend to eat more high-fat meals and less fruits and vegetables compared to those from better socioeconomic backgrounds [5]. The higher incidence of asthma in low-income communities may be attributable to these inequalities in access to appropriate healthcare and nutrition.

Inhaled corticosteroids, long-acting beta-agonists, and oral medicines are now used to treat asthma for long-term management [6, 7]. Oral corticosteroids, beta-agonists, and inhaled bronchodilators are utilized for acute episodes [8-9]. Asthma flare-ups caused by airborne allergens including cigarette smoke, particle matter, pollen, mold, or dust mites may be mitigated by environmental control methods (such as humidity regulation, vacuuming, and pest management) [10, 11]. However, environmental control methods do not solve the problem from the inside [12]. Researchers have shown that granulocytes (which include eosinophils, lymphocytes, macrophages, and mast cells) have a role in airway hyperresponsiveness [13, 14]. These cells cause bronchial smooth muscle spasm, microvascular leakage, and mucus production after an allergic response [15, 16].

The main aims of our systematic review are:
1. To investigate the nutritional status and role of nutrition in prevention of asthma.
2. To assess the role of nutrition in the treatment of asthma.
3. To systematically search literature to synthesize evidence about the role of asthma in asthma prevention and treatment.

Methods:-

Eligibility Criteria

- Studies including participants of any age
- Diagnosed within the asthma according toICD-11

Exclusion of:

1. Animal studies
2. Articles focusing on special dietary requirements for asthma patients
3. Participants diagnosed with asthma and any other chronic conditions that may affect their dietary intake

Study types

Randomised control trials (RCT), non-RCT, observational studies, case control studies. Case reports and case series were excluded.

Outcomes

Primary:

Assessment of role of nutrition in prevention and treatment of asthma.

Secondary:
Assessment of food and fluid intake, dietary patterns, total energy intake and specific nutrient intake (macronutrient and micronutrients), micronutrient status, vitamin levels, vitamin D levels, status, iron levels, etc.

Data collection and analysis
Two reviewersextractedthe following information from selected articles using the reference software Endnote 20. In order to remove duplicate articles and track the numbers required for the PRISMA flow diagram, reviewersthentransferred articles into Covidence, a systematic review management tool.

1- Publication subtleties: title, authors, journal name and year and city and country in which the review was led.
2- Study subtleties: study design (cross-sectional, cohort, case-control), settings (clinical or population based), concentrate on transience (planned or review), patients' enlistment techniques (successive or non-continuous), the geographical area, year of information assortment and response rate, qualification (consideration and avoidance rules), name of appraisal tool(s), approval of evaluation tool(s).
3- Study members' subtleties: number of people reviewed/examined, population qualities including mean age (SD), and gender distribution, relationship status, demographic data.

Data analysis
The data that were recovered were entered into the Statistical Package for the Social Sciences, known as SPSS, and coded before a frequency analysis that was carried out in order to determine patterns of similarity. The content that is duplicated throughout the selected articles were organized into its own individual tabs so that it could be seen more clearly. The data was collected from the study that is considered to be eligible using descriptive statistics. After that, a narrative synthesis was constructed using the summaries of the selected articles. Forest plots was generated using extracted data entered to SPSS.

Study selection
Out of the whole list returned by the database search, one reviewer chose the most relevant titles. The abstracts of the remaining studies were reviewed first, following the aforementioned inclusion and exclusion criteria, after duplicates have been culled from the list using reference works. Second reviewer then categorized the research as "include," "unsure," or "reject". An impartial third party was contacted in the event of a dispute.

Data synthesis
We expect that, owing to the nature of the topic, there would be plenty of published randomized and non-randomized control studies accessible. In order to do this, two reviewers utilized a data extraction table to compile information on the study's design, population, inclusion/exclusion criteria, sample characteristics, methodology, and findings. This data was utilized to conduct in-depth analyses of the papers, from which appropriate conclusions were drawn to provide answers to the research questions. After assessing the title, abstract, and full text of the studies according to the eligibility criteria, the data of interest was collected using a standard form. The following information was collected:

1. Authors,
2. Date,
3. Setting,
4. Diagnosis of asthma,
5. Management approach for asthma,
6. Nutrition

Search strategy
The studies were identified through search in PubMed, Cochrane library, Embase, Scopus, Web of Science, CINAHL, OVID and google scholar databases. Grey literature was also searched.The search wasconducted selecting articles published in all languages. Moreover, selected articles were chosen from peer-reviewed journals. The reference lists of the selected articles were also screened to find additional articles. The selected period during the search was (2000– present).

Keywords
Nutrition OR Asthma OR Prevention OR Management OR Wheeze OR Role OR Mechanism OR Systematic OR Nutritional intervention

Resutls:-

A total of 12,215 studies were identified in the search, all of them were assessed for eligibility, and 12 articles were included in this review (Figure 1).

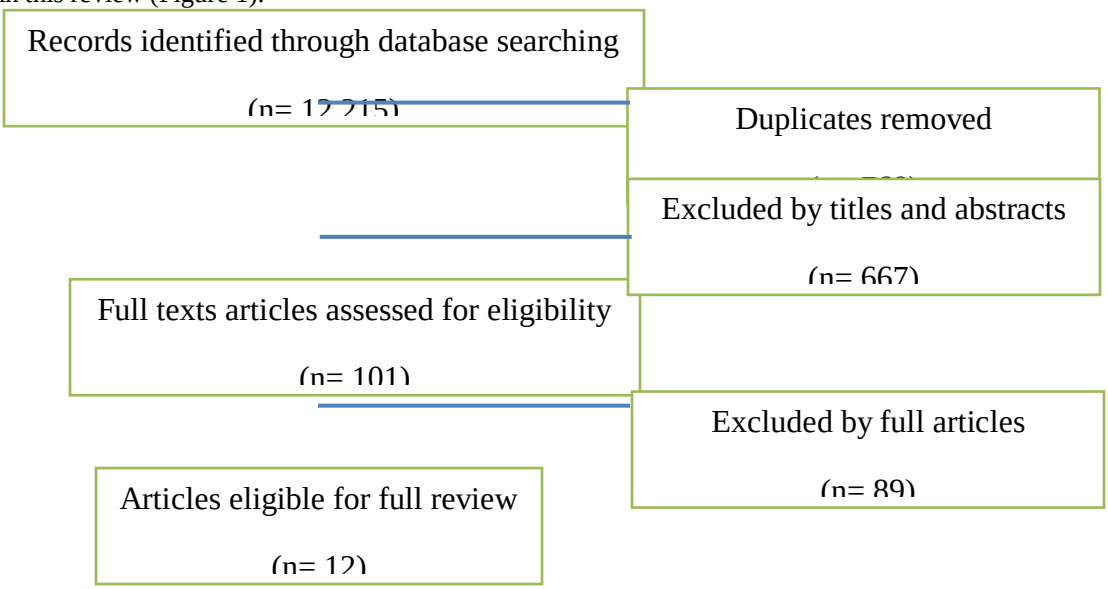

Figure 1:- Study-flow diagram showing the number of studies screened, assessed for eligibility and included in the review.

Weight loss (low-calorie diets and calorie restriction), dietary pattern (Mediterranean-type diet, antioxidant-rich versus antioxidant-poor), antioxidants (isolated supplementation or combinations of micronutrients with potential antioxidant effect), lipids (omega-6 and omega-3 polyunsaturated fatty acids, conjugated linoleic acid [CLA], and miscellaneous) and other dietary interventions were separated into their own sections (dairy, vitamin D, salt, propolis, and caffeine).

We identified three randomized controlled trials (RCTs) that looked at the effectiveness of low-calorie diets for weight reduction in asthma [17-19]. Brazil [19], Australia [18], and Finland all contributed to the research [17]. Overweight [18] and obese [19] individuals made up 33 to 46 of the total sample sizes [17, 19]. Participating individuals' ages varied widely, from 20 to 68 years old. When comparing studies, just one sample had a balanced gender ratio [18]. Another study was done almost entirely in female participants (93.3%) [19], while Stenius et al. did not specify the gender of their participants [17].

Body mass index, degree of asthma control, lung function, quality of life, and other indicators were used to assess success [17-19]. All three trials showed significant weight loss from baseline [17-19], with reductions ranging from around 7.5% to 11.3%. In all trials measuring this outcome, those on the low-calorie diet had a statistically and clinically significant better degree of disease control (ACQ score) [18-19]. Clinically substantial improvement in lung function was seen, with a rise in FEV1 (% predicted) of around 7.6% (95%CI 1.5% to 13.8%) [17]. Clinically significant gains in quality of life were shown in all three investigations, ranging from 0.9 points on the AQLQ [18] to 10-14 points on the SGRQ [17, 19]. Calorie restriction that results in weight loss of at least 7.5% of baseline body weight may help obese people with asthma gain better disease management, quality of life, and pulmonary function. Few randomized controlled trials (RCTs) including food intervention exist, and those that do have limitations in terms of sample size, length of follow-up, and intervention type weaken the strength of the evidence (time, prescribed diet, diet alone or combined with other strategies).

To this review, we added seven randomized controlled trials [20-26] that looked at the impact of antioxidant vitamin and mineral supplementation on asthma-related outcomes. The United Kingdom was the site of four investigations [22-24, 26], the United States of America was home to two 21, 25], and Iran contributed one [20]. Research included anything from eight patients [21] to three hundred [23].

Vitamins C and E, together with the minerals magnesium and selenium, were the supplements used in the treatments. Four randomized controlled trials looked at how well vitamin C supplementation alone (between 1 and 1.5 g daily) worked [20-21, 23-24]. Supplemental vitamin E (250 mg) was also studied [22] to determine its individual impact. The effects of magnesium supplementation alone (340 to 450mg/day) have been examined in three research [23-25], while the effects of 100 g selenium supplementation have been examined in one study [26]. Two weeks [21] to six and a half months were used as the intervention duration [25].

Control of asthma symptoms [20-26]; quality of life [23, 25-26]; and [24]. In just one trial comparing magnesium supplementation to placebo did patients report an increase in their asthma's degree of control (ACQ score) [25]. One research found that vitamin C supplementation had a substantial effect on pulmonary function after exercise [21], with a reduced reduction in FEV1 after exercise when compared to regular diet or a placebo. Five additional trials did not find any change in FEV1 following vitamin or mineral therapy. When compared to placebo, there was no statistically significant improvement in quality of life (AQLQ) [23, 25]. Additionally, unlike with placebo, supplementation did not correlate with a decreased need for bronchodilators (inhaled corticosteroids) [2-23, 26].

There were just two randomized controlled trials looking at the relationship between food and asthma in adults. Both studies were done in Australia; one included 137 people and the other 38 people from the United States [27-28].

Two studies, one from the United States and one from Australia, looked at the health benefits of eating a Mediterranean-type diet high in antioxidant-rich foods. Fruits, vegetables, legumes, nuts, whole grains, and olive oil made up a large portion of the Mediterranean diet, with moderate to high consumption of fish oil, moderate consumption of dairy products, and low consumption of red meat, chicken, and omega-6 fatty acids [27]. The antioxidant-rich eating pattern included at least five servings of vegetables and two servings of fruit per day, together with or without lycopene supplementation (from tomato extract) [28]. Australian study [28] intervention time was 2 weeks; American research was 12 weeks [27].

Asthma control, lung function, and quality of life were the outcome measures used [27-28]. Although the observed result was statistically significant (improved asthma control (ACQ score), high consumption of foods with possible antioxidant effect was associated with a lower prevalence of asthma symptoms), this association was not supported by clinical evidence [28]. Sample size, adequate lung function among participants (FEV1 >60%), lack of control over daily calorie intake, and lack of monitoring of dietary choices might all be methodological flaws that led to the lack of a favorable outcome. Thus, there is insufficient evidence to state that these dietary patterns are associated with clinical improvement of asthma in adults, despite the fact that both studies reported a healthy dietary pattern and the Mediterranean diet is clearly beneficial to cardiovascular health due to its potential anti-inflammatory effect [27-28]. Figure 2 shows the effect of nutrition on asthma prevention and management.

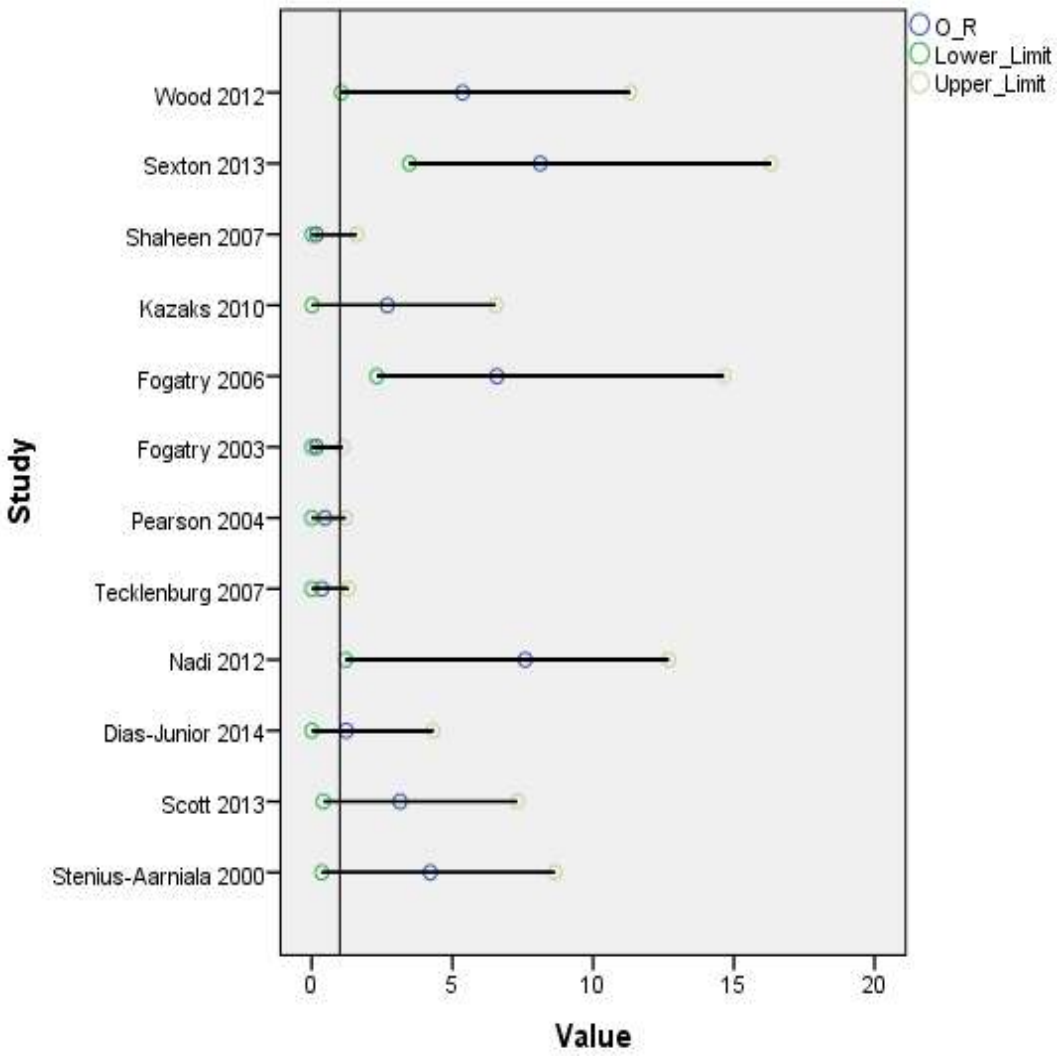

Figure 2:- Forest plot of role of nutrition in prevention and management of asthma.

Discussion:-

There is still more work to be done to standardize the measurement of dietary factors and asthma outcomes among epidemiological studies. We limited our discussion to widely recognized definitions of "asthma" used in epidemiological research to cut down on the confusion that might result from using so many different terminology. In pediatric epidemiological research, "self-reported asthma" and "wheeze" have both been shown to be accurate measures of the disease's prevalence. Consistency in the wording of questions on asthma questionnaires has been shown to improve their efficacy. The most popular method used by epidemiologists to estimate the prevalence of asthma, especially in children, is the reporting of wheeze in population-based research. Standardized usage of wheeze-related questions is important despite potential variances in the term between nations. Recurrent (unremitting) wheeze is specific of pediatric asthma, and it correlates significantly with its clinically defined phenotype, according to recent developments in examining the validity of wheeze as a proxy for asthma diagnosis in epidemiological research [29, 30]. The use of a physician's diagnosis of asthma has also been found to be diagnostic in epidemiological research [31].

In youngsters, dietary antioxidants were shown to have the most protective impact against asthma. Children with greater vitamin D, fruit, and Mediterranean diet intakes had a lower incidence of wheezing, according to two meta-analyses [13]. These results are consistent with those of a recent cohort research on 1924 kids, which found that vitamin D and E consumption was inversely related with the risk of developing asthma by age 10 [32]. These findings provide credence to the idea that consuming antioxidant-rich foods may help mitigate the symptoms of

asthma. To far, randomized controlled trials (RCTs) on dietary antioxidants (single or mixed) have not shown any evidence to support the use of nutritional supplements in the prevention or improvement of asthma management in adults and children [4-6].

There is currently just a small amount of evidence from food intervention studies in asthmatic participants to help us understand the impact that certain foods may have on respiratory health, but newer research indicate that RCTs with foods are feasible. In people with asthma, a decrease in inflammatory markers was linked to a diet that included more fruits and vegetables [7]. However, this association did not hold true for clinical outcomes of the condition. An experiment is under way to see whether pregnant women who consume more antioxidants have children with lower rates of asthma [33]. Recent evidence from a pilot research conducted on asthmatic children between the ages of 6 and 10 by Garcia-Larsen et al. [34] shows that testing the effects of a fresh fruit intervention on asthma-related symptoms is feasible.

Two more systematic reviews were found to have been published after our first search was conducted. Ten observational studies were reviewed by Brigham et al. [35] to determine the strength of the link between adult asthma and "Western" food habits. In meta-analyses included 70 000 people, the authors found no association between a "Western" diet and the risk or prevalence of asthma. Weak evidence supported a link between more severe asthma symptoms and a more "Western" diet. In a recent systematic analysis of prenatal dietary exposure and asthma, Netting et al. [36] found that children born to mothers who followed the Mediterranean diet or who ate plenty of fruits, vegetables, seafood, and vitamin D-rich foods had a reduced chance of developing asthma as adults.

The scope of our review was restricted to dietary exposures that occur naturally in the diet, as opposed to those that occur via the use of nutritional supplements. The goal of this study was to offer supporting data on the impact of diet in order to better inform public health recommendations. Due to the narrow focus of this review, results should only be interpreted in relation to asthma, wheeze, or lung function measurements in asthmatic participants.

Conclusion:-

According to the available data, calorie restriction is the most effective dietary intervention for obese individuals with asthma, independent of the exact foods eaten or the dietary pattern followed. There is not yet enough information on the effects of dietary changes, either alone or in combination, on the control of adult asthma. In order to determine the true impact of nutrition on asthma-related outcomes, further randomized controlled trials should be done with bigger sample numbers and longer follow-up. The findings of this analysis may inform the design of food and nutrition education programs for this demographic, as well as aid scholars interested in the topic form hypotheses.

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