

Multiple Aspects of Renin-Angiotensin System Functions in DASH Diet Interventions

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DESCRIPTION

It is generally known that hypertension, obesity and other metabolic disorders are among essential risk factors of dangerous cardiovascular events and several pharmacological interventions have been introduced to stabilize cardiovascular parameters at optimum levels. Mechanisms responsible for development of hypertension and heart failure, and in particular the pathogenic role of the Renin-Angiotensin System (RAS) have been also intensely investigated [1-8].

Positive effects of DASH diet

Recently, the nonpharmacological approaches based on lifestyle interventions have been proposed to stop development of cardiovascular diseases [9-11]. Specifically, the Dietary Approaches to Stop Hypertension (DASH) intervention has been recommended in patients with hypertension and heart failure. The DASH diet contains reduced amounts of total and saturated fat and cholesterol and elevated amounts of potassium, calcium, magnesium, dietary fiber, and protein in comparison to the typical diet. There are several differences between content of DASH diets used by individual investigators [12]. In most studies a DASH score is based on that proposed by Fuang, et al. [13], and contains fruits, vegetables, nuts and legumes, dairy, whole grains, red meat, sugar-sweetened beverage, sodium and low monosaturated to saturated fat ratio. In many aspects the content of the DASH diet is similar to the composition of a Mediterranean Diet (MED), which contains fruits, vegetables, nuts, whole grains, legumes, fish, red meat, alcohol (usually red wine), and low monosaturated to saturated fat ratio (not exceeding 0.46) [14]. Thus, the DASH diet does not include alcohol, which is recommended in the MED diet. Several randomized control trials and meta-analyses provided evidence for beneficial effects of these diets in patients with cardiovascular diseases [9-11, 15,16]. Recently, it has been reported that both the DASH diet and the Mediterranean diet significantly reduce mortality in a general population and in patients with diabetes mellitus of type II [17-19].

In some clinical trials effects of sodium restricted DASH diet (low sodium DASH diet) were studied, showing that the low sodium DASH diet improves myocardial contractility and ventricular arterial coupling, reduces blood pressure and fluid retention and decreases free saturated acids and triglyceride levels [20-22].

DASH diet and renin-angiotensin-system

Several efforts have been made to elucidate the mechanism of positive effects the DASH interventions. Recently, it has been proposed that the DASH diet may act *via* an interaction with the renin-angiotensin system. RAS belongs to multifunctional regulatory systems. Numerous studies have shown that various components of this system regulate cardiovascular parameters, water-electrolyte balance, metabolism and energy balance both *via* direct cellular actions, and indirectly by co-operation with other hormones (aldosterone, vasopressin, insulin) and the autonomic nervous system [4,8,23-24].

The over-activation of RAS participates significantly in pathogenesis of cardiovascular diseases [4-8,12,25]. In this line vast literature provides evidence that hypertension is associated with activation of central and peripheral RAS systems and shows that in various forms of hypertension increased activation of AT1 angiotensin receptors plays significant role in generation of hypertrophy and fibrosis of the heart and vessels, overstimulation of the sympathetic system, and elevated retention of sodium and water [23,25]. Similarly, during the post-infarct heart failure enhanced activation of RAS contributes markedly to remodeling of the heart and impairment of its working parameters, and causes disturbances of water-electrolyte balance [26-28]. Inappropriate action of RAS systems in the brain, cardiovascular, renal and adipose tissues play also significant role in development of cardiometabolic syndromes and resistance to the metabolic actions of insulin [4,29-34].

The DASH diet significantly alters interactions of RAS with cardiovascular and hormonal systems [5,35] and there are several reasons to believe that correction of the inappropriate function

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Received: 22-Apr-2022, Manuscript No. APCR-22-16681; **Editor assigned:** 25-Apr-2022, Pre QC No. APCR-22-16681 (PQ); **Reviewed:** 09-May-2022, QC No. APCR-22-16681; **Revised:** 16-May-2022, Manuscript No. APCR-22-16681(R); **Published:** 23-May-2022, DOI: 10.35248/2161-0940.22.S8.385.

Citation: Sadowska ES (2022) Multiple Aspects of Renin-Angiotensin System Functions in DASH Diet Interventions. *Anat Physiol*. S8: 385.

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of RAS significantly contributes to positive effects of DASH diet in cardiovascular diseases. Thus far, the role of specific components of RAS in DASH diet has not been sufficiently well investigated and there are several gaps to understand how they operate during various metabolic disorders. In particular the role of Ang-(1-7) is worth of attention as both experimental and clinical data show that in many respects this peptide acts contrary to Ang II, and that its positive effects are present in obesity [36-39]. Recently, it has been shown that enrichment of diet of Wistar rats with olive oil causes inhibition of RAS in the kidney and decreases levels of Ang II, Ang III, Ang IV and Ang-(1-7) peptides in the brain [40,41]. As olive oil is present both in the DASH and the MED diet, it is likely that some as yet not identified constituents of this oil which interact with the brain and systemic RAS may significantly contribute to beneficial effects of these diets.

Nevertheless, it should be noted that in spite of several studies showing beneficial effects of the DASH diet on the cardiovascular system [42], it is not yet fully recognized whether this diet should be recommended in all populations. Namely, it has not been solved whether the DASH diet should be adhered by pregnant women [43]. There are also some objections with regard to effectiveness and safety of the DASH diet in patients suffering from chronic kidney and liver diseases, diabetes mellitus of type II, lactose intolerance, and celiac disease, as well as in those treated with antagonists of the renin-angiotensin-aldosterone system. Such patients should be under careful clinical observation during the DASH diet regimen and the food content should be modified adequately to the clinical state of the patient [16,44].

CONCLUSION

Current evidence indicates that the DASH diet significantly influences activity of the renin-angiotensin system, however not all links of the DASH diet with the RAS system have been sufficiently explored and effectiveness of the DASH diet has not been fully recognized in all populations. Better deciphering of interactions of different types of DASH diet with specific components of RAS should be helpful in better programming successful treatment of cardiovascular diseases.

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