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EDITORIAL

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Nonalcoholic steatohepatitis: Prevention by nutraceuticals from essential oil and changes of colonic microbiota

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Introduction

Non-alcoholic steatohepatitis (NASH) is an excessive fat accumulation in the liver with high oxidative stress and inflammation and initiation of cirrhosis. Obesity, diabetes and metabolic syndrome might be associated with fatty liver which if not well controlled could be progressed to NASH. Excessive consumption of high fructose and saturated fats in the daily diet together with a sedentary lifestyle could lead to a fatty liver with subsequent possibility of NASH development [1,2]. NASH has been accused for developing cardiovascular disease while NASH itself might progress to liver cirrhosis, hepatocellular carcinoma and end to liver failure [3]. Therefore, mitigating NASH is essential to prevent the aforementioned more serious conditions. So far, no efficient remedy is present for subsiding NASH. In addition, colonic dysbiosis might be an important factor in developing NASH. Research published in the Journal of Oleo Science entitled "Basil essential oil and its nano-emulsion mitigate non-alcoholic steatohepatitis in rat model with special reference to gut microbiota" discussed the potential prevention of NASH by basil essential oil (BO) and its nano-emulsion form (BNO) in addition to the interrelation of microbiota in the incidence and prevention of NASH [4]. Basil (*Ocimum basilicum*) essential oil was analyzed by GC-MS and showed to contain 23 volatile compounds, from which the major component was linalool followed by eucalyptol, eugenol and α-bergamotene. Different nano-formulations were prepared from BO by applying the low-energy spontaneous emulsification technique. The most stable and ultrafine nano formula (BNO) with 15.42 nm particle size was selected and tested in rat NASH model in a dose of 50 mg/kg rat body weight compared to BO (100 mg/kg rat body weight) and NASH control (SC) and normal control group (NC). It is worth mentioning that the author used BNO in half the dose of BO expecting high bioavailability of the nanoform. NASH model was induced in rats by feeding a high fructose high saturated fat diet deficient in choline. Plasma lipid profile, interleukin-6 and lipopolysaccharides were assessed. Plasma and colon content of lipocaline (LCN2) and liver fat were determined. Colon microbiota represented by *Firmicutes* (F) and *Bacteriodetes* (B) were assayed by real time polymerase chain reaction and the ratio F/B was calculated. The histopathological examination of the Liver and colon was carried out. The SC group showed a significant increase in liver fat, plasma total cholesterol (TC), triglycerides (TGs), low-density lipoprotein-cholesterol (LDL-C) with a reduction of high-density lipoprotein-cholesterol (HDL-C) compared to the NC group. Also, significant increases in plasma TC/HDL-C, LCN2 and Interlukin-6 were observed in the SC group compared to the NC group. Colon LCN2 and F/B were noticed to be significantly elevated in the SC group compared to the NC group. Histopathological examination of the liver demonstrated fatty degeneration with fibroblast activation while the colon showed erosion and mucosal epithelium detachment in the SC group.

The authors reported that NASH pathophysiology might include intestinal dysbiosis, inflammatory cytokines and dyslipidemia. The authors mentioned that high fructose was shown to elevate *Bacteriodetes* and *Clostridium* in the colon while reducing the beneficial *Bifidobacteria* and *Lactobacilli* and inducing inflammation in the gut that leads to gut permeability which precedes dyslipidemia, liver inflammation and hepatic fat deposition leading to NASH according to previous study [5]. Also, the authors stated that choline deficient diet induced liver fat deposition because choline is important for methylation and transportation of lipids from the liver and it participates in induction of dysbiosis as shown in previous work [6]. As *Firmicutes* and *Bacteriodetes* phyla constitute about 90% of intestinal microbiota, the authors investigated their changes specially that during obesity and NASH an increase in Firmicutes and a reduction in Bacteriodetes were reported. Gut microbiota control pro-inflammatory signaling pathways like toll-like receptors (TLR) and Nod-like receptors (NLR), therefore imbalance of microbiota could lead to inflammation as shown by the elevated inflammatory cytokine (IL-6) in the SC group in such study as declared by the authors. High serum IL-6 has been correlated with fatty liver diseases as cited by the authors.

The authors mentioned that LPS, the cell wall component of gram-negative bacteria, is an indicator of microflora translocation. Microflora translocation occurs as a result of increased intestinal permeability and overgrowth of bacteria along with impaired immunity all could lead to NASH complications represented by cirrhosis, morbidity and mortality. The authors reported no changes in LPS in their study that negate translocation despite the occurrence of erosion and detachment of mucosal epithelium in the SC

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group from histopathological results. The authors explained the unchanged in LPS based on the short length of the experiment that if elongated the translocation could be observed.

It has been stated that LCN2 could be assumed as a NASH biomarker because fatty liver, and liver inflammation and damage and elevated IL-6 induced the release of LCN2 because it can work as a hepatoprotective agent. It was also mentioned that bacterial growth might be limited by LCN2 through sequestering iron thereby amending microflora imbalance. Also, LCN2 can prevent intestinal inflammation by enhancing phagocytic bacterial clearance and it was suggested by the authors that new remedy for NASH must target LCN2 as NASH biomarker.

Oral administration of either BNO or BO in the study exhibited marked improvement of NASH. BNO administration was more efficient in reducing liver fat, histopathological changes and F/B than BO while BO was superior in decreasing plasma TGs, TC and LDL-C. Such effect was ascribed by to the synergistic effect of the different volatile components with a mechanism involving antioxidant, anti-inflammatory, lipid-lowering and liver protection. The authors reported that improving liver lipids and F/B on treatment with BNO using half the dose of BO might be explained based on increased bioavailability and the action of the essential oil on formulating in nano-form. The result was confirmed by a previous study that showed antioxidant, anti-inflammatory, lipid-lowering and prevention of NASH and metabolic syndrome by nano-eugenol which is one of the volatile constituents of basil [7]. Linalool, a monoterpene alcohol, which is also another component of the volatile oil has anti-inflammatory, antioxidant, antimicrobial and cell regeneration effects. Linalool also increased the relative abundance of *Lactobacillus* in the colon (improved dysbiosis). The terpenoid oxide, Eucalyptol, as another constituent of the essential oil possesses a protective effect towards colon damage and CVDs through the reduction of LPS-induced pro-inflammatory cytokine including IL-6 and suppresses oxidative stress by radical scavenging activity.

The study showed BO to possess in-vitro antibacterial effects towards *Yersinia enterocolitica, Staphylococcus aureus (ATCC6538)*, and *Listeria monocytogenes* that might have a hand in improving dysbiosis through inhibiting pathogenic bacterial growth in the colon.

The study concluded that both BO and BNO inhibit the progression of steatohepatitis in rat with a mechanism involving an effect on colonic microbiota balance. The strength in the study resides in highlighting the changes in microbiota during NASH and after treatment with basil essential oil as nutraceuticals. In addition, the study proposed LCN2 as a biomarker of NASH that could be followed during the testing of new anti-NASH agents. It is worth mentioning that it would be very interesting if the authors investigated different beneficial microorganisms in the colon exemplified by *Bifidobacteria* and *Lactobacilli*.

Disclosure statement

No potential conflict of interest was reported by the author.

References

1. Yki-Järvinen H. Non-alcoholic fatty liver disease as a cause and a consequence of metabolic syndrome. Lancet Diabetes Endocrinol. 2014;2(11):901-910. https://doi.org/10.1016/s2213-8587(14)70032-4
2. Al-Okbi SY, El-qousy SM, El-Ghlban S, Moawad HF. Role of borage seed oil and fish oil with or without turmeric and alpha-tocopherol in prevention of cardiovascular disease and fatty liver in rats. J Oleo Sci. 2018;67(12):1551-1562. https://doi.org/10.5650/jos.ess18064
3. Chu H, Williams B, Schnabl B. Gut microbiota, fatty liver disease, and hepatocellular carcinoma. Liver Res. 2018;2(1):43-51. https://doi.org/10.1016%2Fj.livres.2017.11.005
4. Al-Okbi SY, Amin MA, Mohamed AE, Edris AE, Sharaf OM, Mabrok HB, et al. Basil essential oil and its nanoemulsion mitigate non-alcoholic steatohepatitis in rat model with special reference to gut microbiota. J Oleo Sci. 2020;69(8):913-927. https://doi.org/10.5650/jos.ess20067
5. Do MH, Lee E, Oh MJ, Kim Y, Park HY. High glucose or -fructose diet cause changes of the gut microbiota and metabolic disorders in mice without body weight change. Nutrients. 2018;10(6):761. https://doi.org/10.3390/nu10060761
6. Ye JZ, Li YT, Wu WR, Shi D, Fang DQ, Yang LY, et al. Dynamic alterations in the gut microbiota and metabolome during the development of methionine-choline-deficient diet-induced nonalcoholic steatohepatitis. World J Gastroenterol. 2018;24(23): 2468-2481. https://doi.org/10.3748/wjg.v24.i22.2468
7. Al-Okbi SY, Mohamed DA, Hamed TE, Edris AE. Protective effect of clove oil and eugenol microemulsions on fatty liver and dyslipidemia as components of metabolic syndrome. J Med Food. 2014;17(7):764-771. https://doi.org/10.1089/jmf.2013.0033

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