Publications

- **Kulshrestha, Shruti**, Rhydham Karnik, Aliasgar Vohra, Apeksha Joshi, and Ranjitsinh Devkar. “Exogenous melatonin corrects hepatic Nocturnin levels in experimentally induced MASLD.” ***Journal of Endocrinology and Metabolism*** 28, no. 2 (2024): 01-13.

- **Kulshrestha, Shruti**, and Ranjitsinh Devkar. "Circadian control of Nocturnin and its regulatory role in health and disease." ***Chronobiology International*** 40, no. 7 (2023): 970-981.

- **Kulshrestha, Shruti**, Apeksha Joshi, Aliasgar H. Vohra, Rhydham Karnik, Nilay Dalvi, Felix Christian, Ashutosh Kumar, and Ranjitsingh V. Devkar. "EP115 NOCTURNIN: A PUTATIVE TARGET OF MELATONIN MEDIATED IMPROVEMENT IN EXPERIMENTALLY INDUCED NAFLD." ***Gastroenterology*** 164, no. 6 (2023): S-1433. **(Abstract)**

- Vohra, Aliasgar, Rhydham Karnik, Mansi Desai, Hitarthi Vyas, **Shruti Kulshrestha**, Kapil Kumar Upadhyay, Prakash Koringa, and Ranjitsinh Devkar. "Melatonin-mediated corrective changes in gut microbiota of experimentally chronodisrupted C57BL/6J mice." ***Chronobiology International*** 41, no. 4 (2024): 548-560.

Conferences

- Presented research work in the form of an **oral presentation** in **National Conference on Scientific Innovations Towards Developed India** held on 28th February, 2024 at the Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara-390002, Gujarat.

- Presented research work in the form of an **oral presentation** in the **International Conference on Molecular Medicine, Reproduction and Endocrinology** held during 14th-16th September, 2023 at Navrachana University, Vadodara, Gujarat. Awarded **1st Prize** in the **Prof. N.J. Chinoy Best Paper** category for the same.

- Presented research work in the form of **virtual poster** in **Digestive Disease Week 2023 (DDW-2023)** held during 6th-9th May 2023.

- Presented research work in the form of **poster** in the **International Conference on Reproductive Biology, Comparative Endocrinology and Development and the 39th Annual meeting of the Society for Reproductive Biology and Comparative Endocrinology** during 14th-16th September 2023 at the CSIR-Centre for Cellular and Molecular Biology (CCMB), Hyderabad. Awarded **3rd Prize** in the **Prof. N.J. Chinoy Best Paper** category.

- Attended **Hands-on training program on Basic Bioinformatics** during 7th-11th March, 2022 at **Gujarat Biotechnology, Research Centre (GBRC),** Gandhinagar, Gujarat.

Co-authored abstracts

- Devkar, R. V., Karnik, R., Dalvi, N**., Kulshrestha, S**., & Vohra, A. H. (2023). Sa1590 CIRCADIAN SHIFTS IN STEATOTIC LIVER ALTERS INTRA AND EXTRA-HEPATIC OSCILLATIONS OF MIR 122. *Gastroenterology*, *164*(6), S-1305.

- Karnik, R., Vohra, A., Vyas, H., Dalvi, N., **Kulshrestha, S.**, & Devkar, R. (2022). EP1219: Melatonin improves gut dysbiosis in high fat-high fructose diet model of nafld and/or photoperiod induced chronodisruption in c57bl/6j mice. *Gastroenterology*, *162*(7), S-1290.

- Vohra, A. H., Upadhyay, K., Joshi, A., Vyas, H., **Kulshrestha, S**., & Devkar, R. (2021). Sa383 Exogenous melatonin improves liver function and neurobehavioral desynchrony in experimentally induced life style disorder in c57bl/6j mice. *Gastroenterology*, *160*(6), S-843.

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Exogenous Melatonin Corrects Hepatic Nocturnin Levels in Experimentally Induced MASLD

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Abstract

Melatonin, a neurohormone, improves hepatic function in diet and/or chronodisruption in Metabolic dysfunction Associated with Steatotic Liver Disease (MASLD). Nocturnin (Noct), a circadian clock output gene, putatively regulates hepatic lipid metabolism but the underlying mechanisms related to its regulation remain largely unknown. Herein, we hypothesise that melatonin-mediated improvement in liver function in MASLD is regulated via Noct and this study delves into Noct as a putative target of melatonin. Molecular docking studies (Autodock, Pyrx and PyMol) confirmed interactions between melatonin and mouse Noct (Binding affinity: -7kcal/mol; RMSD: 0). Further, studies on C57BL/6J mice comprised of experimental groups viz. high-fat-high-fructose (H) diet fed, photoperiodic shifts-induced chronodisruption (CD) or a combination of the two (HCD) wherein melatonin-mediated improvements in serum lipid profile (TGs, total lipids, VLDL-chol., LDL-chol. and total cholesterol) and liver function markers (ALT and AST) were recorded. Further, the fatty manifestations, hepatocyte ballooning, and steatotic score were significantly improved following exogenous melatonin. Likewise, the liver samples of H, CD and HCD mice recorded a marked increment in hepatic Noct mRNA expression whereas melatonin administration accounted for a significant improvement in the said expression. These findings were further validated *in vitro* in HepG2 cells treated with Oleic Acid (OA) cells wherein, melatonin supplementation improved Noct mRNA and protein expressions compared to the disease control. Taken together, this study provides insight into melatonin-mediated modulation in hepatic Noct that correlates with improved hepatic health in experimental models of MASLD.

Keywords: Chronodisruption, High Fat High Fructose Diet, MASLD, Melatonin, Nocturnin

1. Introduction

Biological clocks are innate timekeeping systems that synchronize with the light-dark cycles to maintain homeostasis[1]. The master circadian clock in the suprachiasmatic nucleus synchronizes with the tissue-specific peripheral clocks to maintain physiological homeostasis[1,2]. Melatonin, a pleiotropic neurohormone secreted by the pineal gland is an important component of the circadian clock machinery. Melatonin signals regulate the circadian organization of a plethora of physiological processes such as immune responses, antioxidant defence, glucose regulation and energy homeostasis[3,4]. As a potent chronobiotic, melatonin influences the circadian timing of metabolic processes, aligning them with the activity/rest cycles[5]. Over the years, several studies have reported the hepatoprotective effects of melatonin in lifestyle disorders such as metabolic dysfunction-associated steatotic liver disease (MASLD) that progresses to an irreversible condition called metabolic dysfunction-associated steatohepatitis[6-9] (MASH; formerly known as NAFLD and NASH, respectively). The therapeutic role of melatonin has been documented in an experimental model of MASH wherein mice fed with a high-fat diet (HFD) had shown significant improvements in steatotic score and related parameters such as inflammation and

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REVIEW ARTICLE

Circadian control of Nocturnin and its regulatory role in health and disease

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ABSTRACT

Circadian rhythms are generated by intrinsic 24-h oscillations that anticipate the extrinsic changes associated with solar day. A conserved transcriptional–translational feedback loop generates these molecular oscillations of clock genes at the organismal and the cellular levels. One of the recently discovered outputs of circadian clock is Nocturnin (Noct) or Ccrn4l. In mice, *Noct* mRNA is broadly expressed in cells throughout the body, with a particularly high-amplitude rhythm in liver. NOCT belongs to the EEP family of proteins with the closest similarity to the CCR4 family of deadenylases. Multiple studies have investigated the role of Nocturnin in development, adipogenesis, lipid metabolism, inflammation, osteogenesis, and obesity. Further, mice lacking Noct (*Noct* KO or Noct$^{-/-}$) are protected from high-fat diet-induced obesity and hepatic steatosis. Recent studies had provided new insights by investigating various aspects of Nocturnin, ranging from its sub-cellular localization to identification of its target transcripts. However, a profound understanding of its molecular function remains elusive. This review article seeks to integrate the available literature into our current understanding of the functions of Nocturnin, their regulatory roles in key tissues and to throw light on the existing scientific lacunae.

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KEYWORDS
Nocturnin; circadian clock; lipid metabolism

Introduction

Circadian rhythms are inbuilt timekeeping systems that regulate multiple facets of cellular homeostatic events by orchestrating the synergy of transcriptional outputs culminating in distinct diurnal/nocturnal manifestations (Reinke and Asher 2019). Cells and tissues of complex vertebrates are governed by circadian clock outputs with the central control located in the Suprachiasmatic Nucleus (SCN) of brain (Harder and Oster 2020). Pineal gland produces neurohormone Melatonin that plays a major role in the maintenance of circadian rhythms (Liu et al. 1997). However, cells and tissues have been extensively reported to exhibit circadian rhythms that are independent of the central hormonal control (Bray and Young 2009). This is because cells comprise of genes that form the core clock (*Bmal, Clock, Per1, Per2, Cry1, Cry2, Rev-erbα, RORα*) and are the epicentre of circadian regulation of the said tissues (Isojima et al. 2003; Wood et al. 2020). The core clock genes are responsive to the extrinsic factors and are partially governed by central photo-endocrine axis (Wood et al. 2020). This molecular circuitry forms a transcriptional–translational feedback loop in mammalian tissue that can alter/regulate key metabolic functions in various tissues (Huang 2018; Reinke and Asher 2016).

Biological timekeeping is known to regulate cellular processes via circadian clock gene output (Duong et al. 2011; Isojima et al. 2003). A recently discovered gene known as Nocturnin (Noct) or Ccrn4l; is a member of Exonuclease, Endonuclease, and Phosphatase (EEP) family of proteins (Green and Besharse 1996) and is known to be well-conserved in yeast (Dupressoir et al. 1999), plants and mammals (Carter and Murphy 1989; Pilgrim et al. 1993; Robinson et al. 1988; So and Rosbash 1997; Wilsbacher et al. 2002). Nocturnin was discovered in *Xenopus laevis* retinal cells, wherein its rhythmic mRNA levels were first reported by a differential display method (Baggs and Green 2003). Herein, a robust oscillation pattern of *Noct* mRNA was reported (Baggs and Green 2003). NOCT has a conserved catalytic domain and a sequential similarity with proteins of CCR4 family (Wickramaratne et al. 2022). The N-terminus is only partially structured making NOCT protein functionally distinct than other members of the CCR4 family (Green and Besharse 1996). Nocturnin has been reported to be highly responsive toward any significant perturbation in circadian rhythms or exposure of cells to serum (Garbarino-Pico et al. 2007), mitogens (Garbarino-Pico et al. 2007), lipopolysaccharide (LPS) (Niu et al. 2011), or phorbol ester 12-O-tetracanoylphorbol-13-acetate (TPA). Due to these credentials, *Noct* is listed

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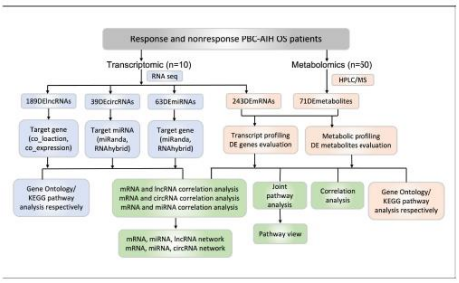

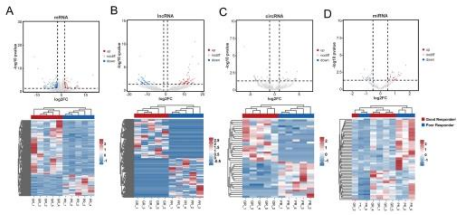

EP114

DISTINCT PATTERNS OF HOST-MICROBE CROSSTALK IN THE PROGRESSION OF NONALCOHOLIC FATTY LIVER DISEASE

Wenjing Yin, Ruixin Zhu, Wenxing Gao, Xinyue Zhu, Lixin Zhu, Na Jiao

Background: Multiple factors contribute to development and progression of nonalcoholic fatty liver disease (NAFLD). However, the potential contributions of microenvironment alterations mediated by host genes and hepatic microbes remain unclear. Here dynamic hepatic microenvironment of progressive stages of NAFLD was investigated focusing on host-microbe interactions. **Methods**: RNA-Seq data from three cohorts including 67 controls, 98 non-alcoholic fatty liver (NAFL) and 211 non-alcoholic steatohepatitis (NASH) patients were reprocessed to obtain information on host gene expression and matched tissue microbial composition. After removing batch effect, specific and stable host-microbe associations were identified by lasso regression and stability selection, whose strength was evaluated by Spearman correlation. Finally, enrichment analysis was performed to assess relevance of the host-microbe associations in driving disease progression. We validated the key associations in an independent dataset. **Results**: We identified dramatic hepatic microenvironment changes along NAFLD development. There were 3992 host-microbe interactions involving 3597 genes and 21 microbes in controls, maintaining the homeostasis. However, only four host-microbe interactions were identified in the collapsed microenvironment of NAFL. Contrarily, hepatic microenvironment in NASH comprised of 6204 robust associations between 6204 genes and 46 microbes, which displayed distinct host-microbe interaction patterns from those of the controls. Nevertheless, 263 shared interactions were identified, with 192 favorable associations diminished and 71 detrimental correlations elevated in NASH. Interactions specific in controls, such as *ATP6V0A2*-Bradyrhizobium and *NDUFS2*-Staphylococcus, were of significance in maintaining the homeostasis via oxidative phosphorylation process, while those exclusively appeared in NASH may facilitate a pathogenetic microenvironment through pathways including mitochondrial ROS production (*ECSIT*-Janthinobacterium) and RIG-I-MAVS signaling (*PRMT9*-Pseudopedobacter). Such key host-microbe associations were also identified in the independent dataset. **Conclusions**: We profiled the host-microbe interactions and identified stage specific characteristics of hepatic microenvironment along the progression of NAFLD. The dynamic host-microbe interactions may shed new perspective towards NAFLD pathogenic mechanisms and potential therapeutic targets. **Keywords**: microenvironment, host-microbe interaction, nonalcoholic fatty liver disease, oxidative phosphorylation, mitochondrial ROS

EP115

NOCTURNIN: A PUTATIVE TARGET OF MELATONIN MEDIATED IMPROVEMENT IN EXPERIMENTALLY INDUCED NAFLD

Shruti Kulshrestha, Apeksha Joshi, Aliasgar H. Vohra, Rhydham Karnik, Nilay Dalvi, Felix Christian, Ashutosh Kumar, Ranjitsingh V. Devkar

High fat high fructose diet (HFFD) induced non-alcoholic fatty liver disease (NAFLD) is a major cause of morbidity and mortality worldwide. In experimental scenario, exogenous melatonin is known to improve liver function by favourably altering the symptoms of NAFLD. *Nocturnin* (*Noct*); a robustly rhythmic gene is known to regulate hepatic lipid metabolism, but its role in NAFLD remains unknown. We hypothesize that Noct is a putative target of melatonin and provide a prima facie evidence in this regard. The study comprised of HepG2 cells subjected to oleic acid (OA) alone or in combination with melatonin to generate an *in vitro* model of NAFLD. Also, C57BL6J male mice were subjected to HFFD for 16 weeks. Melatonin was administered intraperitoneally from 9th week till the end of 16 weeks. After development NAFLD, serum liver function tests, lipid profile and liver histology were performed. Further, molecular docking was performed for mouse NOCT and melatonin using Autodock, Pyrx and Pymol. **Results:** HepG2 cells subjected to OA (0.5mM) showed significant accumulation of lipids (ORO staining) whereas; melatonin treatment (0.1mM) accounted for corrective changes. Further, OA led to a significant increment in *Noct* mRNA whereas; presence of melatonin could lower the same. In C57BL6/J mice, liver function tests (ALT and AST) and lipid profile (total lipids, TGs, LDL-C, VLDL-C, total cholesterol) were significantly elevated in HFFD group whereas; melatonin accounted for corrective changes. Fatty manifestations in hepatocytes due to HFFD treatment, was significantly less in liver of melatonin treated group. *Noct* mRNA was significantly high in hepatic tissue of HFFD-fed mice. Melatonin administration of HFFD-fed mice accounted for significant lowering of *Noct* mRNA. These observations imply towards a NOCT-melatonin interaction that was further investigated using in silico study. Since the complete protein structure of mouse NOCT is not available in protein databases, iTASSER was employed for the same using the available amino acid sequence in NCBI. Further, 3D NOCT structure was validated by Ramachandran Plot (PDBsum structural) analyses. Molecular docking studies between mouse NOCT and melatonin confirmed interactions between the two (Binding affinity: -7kcal/mol; RMSD: 0). **Conclusion:** Melatonin treatment correctively altered liver function in experimental models of NAFLD wherein; a lowered nocturnin mRNA was in synchrony with the observed changes. A nocturnin-melatonin interaction is hypothesized herein as evidenced by inferences of the in silico study.

EP116

THE EFFECT OF SODIUM-GLUCOSE COTRANSPORTER-2 ON NON-ALCOHOLIC FATTY LIVER DISEASE

Elena Kuhareva, Eliza Mankieva, Olga Tarasova, Yannick Ngameni Moyam

Background: the incidence of non-alcoholic fatty liver disease (NAFLD) has increased almost 2-fold over the past 20 years,but there are no medications that can cure NAFLD. A key link in the pathogenesis of NAFLD is a violation of the systemic energy balance, which is characterized by an excess of carbohydrates and fatty acids, which targets pharmacological studies on these metabolic pathways of NAFLD. The results of recent studies have shown that the sodium-glucose cotransporter-2 inhibitors (SGLT-2) have pleiotropic effects, which include a decrease in body weight and blood pressure, an improvement in the lipid profile, an increase in adiponectin secretion, as well as a reduction in the risk of cardiovascular death. **The aim**: to evaluate the effect of sodium-glucose cotransporter-2 inhibitors on NAFLD. **Materials and methods**: 53 patients with NAFLD without diabetes mellitus (28 women (52.8%) and 25 men (47.2%) aged 21 to 64 years (average age 45.9+10.9 years)) were included . The diagnosis of NAFLD/NASH was made according to the criteria of the EASL 2016 clinical guidelines. The liver stiffness was assessed in kPa on the METAVIR scale, the steatosis in db/m by a Fibroscan 502 CAP (Echosens, France). The patients were divided into two groups: in treatment group (n=26) patients used the iNGLT-2 group drug (dapagliflozin 10 mg per day); the control group (n=27) – without therapy. Patients of both groups were comparable in the course of the disease and the main clinical, laboratory and instrumental indicators. The duration of follow-up was 48 weeks (95% CI = 48.2, 49.3). **Results**: in the treatment group (n=26) was found a statistically significant decrease of BMI (p=0.001), waist circumference (p=0.01), steatosis degree (p<0.0001), liver stiffness (p<0.0001), NOMA -IR index (p<0.0001), ALT (p=0.001), cholesterol (p=0.008), LDL (p= 0.04), TG (p=0.001), uric acid (p=0.001). In the control group (n=27) was a statistically significant increase in BMI (0.006), degree of steatosis (p=0.008), liver stiffness (p=0.001). In a one-dimensional comparative analysis of dynamic indicators, a decrease in BMI (p= 0.003), the NOMA-IR index (p=0.006), ALT level (p=0.02), TG (p=0.002), uric acid (p= 0.04) were statistically significant for reducing the degree of steatosis. On multiple regression BMI decrease was statistically significant in reducing of steatosis degree (OR = 4.9; 95% CI 3.463-8.317; p = 0.0001). Steatosis degree decrease (OR = 4.6; 95% CI 0.006-0.017; p = 0.0001), NOMA–IR index decrease (OR=2.1, 95% CI 0.396- -0.008; p = 0.04) were statistically significant in liver stiffness reducing. **Conclusion**: the use of a sodium-glucose cotransporter-2 inhibitor (dapagliflozin 10 mg per day) positively affected the main metabolic components, including liver steatosis and the dynamics of liver stifness in patients with NAFLD.

EP117

PARENTERAL ADMINISTRATION OF SMOF-LIPID HAS LIMITED BENEFIT OVER INTRALIPID IN A NEONATAL PIG MODEL OF OBSTRUCTIVE CHOLESTASIS

Gregory J. Guthrie, Barbara Stoll, Douglas Burrin

Objectives and Study: Biliary atresia (BA) is a neonatal disease that results in the destruction of the extra-hepatic bile ducts, which can lead to liver transplant in 50% of patients. Poor growth rates and failure to thrive elevates risk of poor transplant outcomes in infants with BA. Parenteral nutrition (PN) is administered in some of these infants to optimize nutrient status and improve growth. In infants without BA, soy oil lipid emulsions used in PN are associated with increased risk of cholestatic liver disease, but mixed oil lipid emulsions with fish oil and medium chain triglycerides perform better, potentially through restoration of bile flow. In infants with BA, it is unclear if there is any benefit from mixed emulsions given bile flow is permanently obstructed. The goal of this study is to determine if there is benefit in PN using mixed lipid emulsions vs soy lipid emulsions in a neonatal pig model of obstructive cholestasis to mimic the effects of BA on cholestasis. Methods: Term-age piglets (113 d gestational age) were administered either PN, via central line, containing soy lipid (Intralipid, PN-IL) or mixed lipid (SMOFlipid, PN-SL), or enterally fed pig formula (ENT). The ENT and PN piglets were then randomized to receive either a bile duct ligation of the cystic and common bile ducts (BDL) or a sham incision (SHAM). PN and ENT feeds were administered for 14 days. Results: PN-SL-BDL pig body weight gain was significantly greater than ENT-BDL and PN-IL-BDL pigs. PN-IL-BDL had the lowest weight gain among all

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ORIGINAL ARTICLE

Melatonin-mediated corrective changes in gut microbiota of experimentally chronodisrupted C57BL/6J mice

Aliasgar Vohra[a,b], Rhydham Karnik[a,c], Mansi Desai[d], Hitarthi Vyas[e], Shruti Kulshrestha[a], Kapil Kumar Upadhyay[e], Prakash Koringa[d], and Ranjitsinh Devkar[a]

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ABSTRACT

Chronic consumption of a high-calorie diet coupled with an altered sleep-wake cycle causes disruption of circadian clock that can impact the gut microbiome leading to metabolic syndrome and associated diseases. Herein, we investigate the effects of a high fat high fructose diet (H) alone or in combination with photoperiodic shifts induced chronodisruption (CD) on gut microbiota of C57BL/6J male mice. Further, the merits of daily evening intraperitoneal administration of melatonin in restoring gut microbiota are studied herein. Experimental groups viz. H, CD and HCD mice recorded higher levels of serum pro-inflammatory cytokines (TNF-α and IL-6) and lower levels of the anti-inflammatory cytokine, IL-10. These findings correlate with a concomitant increase in the transcripts of TLR4, TNF-α, and IL-6 in small intestine of the said groups. A decrement in mRNA levels of *Ocln*, *ZO-1* and *Vdr* in these groups implied towards an altered gut permeability. These results were in agreement with the observed decrement in percentage abundance of total gut microflora and Firmicutes: Bacteroidetes (F/B) ratio. Melatonin administration accounted for lower-level inflammation (serum and gut) along with an improvement in gut permeability markers. The total abundance of gut microflora and F/B ratio showed an improvement in all the melatonin-treated groups and the same is the highlight of this study. Taken together, our study is the first to report perturbations in gut microbiota resulting due to a combination of photoperiodic shifts induced CD and a high fat high calorie diet-induced lifestyle disorder. Further, melatonin-mediated rejuvenation of gut microbiome provides prima facie evidence of its role in improving gut dysbiosis that needs a detailed scrutiny.

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KEYWORDS
Melatonin; gut microbiota; photoperiod; chronodisruption; high fat-high fructose diet; inflammation

Introduction

Circadian clocks are inbuilt timekeeping systems that regulate multiple facets of cellular homeostasis with the suprachiasmatic nucleus (SCN) serving as the central circadian pacemaker (Cox and Takahashi 2019; Isojima et al. 2003). This central clock synchronizes with the peripheral clocks to regulate a multitude of physiological processes (Pilorz et al. 2018). Circadian perturbations originating due to shift work (Antunes et al. 2010), exposure to artificial light at night (ALAN) or consumption of high calorie diet are known to cause a higher susceptibility towards lifestyle disorders (Zubidat and Haim 2017). One of the important mediators of the circadian clock responses is melatonin; a neurohormone secreted by the pineal gland (Pevet and Challet 2011). Increasing evidence implies towards the role of melatonin in homeostasis of various physiological processes such as lipid and glucose metabolism (Ali and Madkour 2023; Garaulet et al. 2020). Further, potent antioxidant, anti-inflammatory and anti-hyperlipidemic properties of melatonin have also been established by several research groups (Muñoz-Jurado et al. 2022).

The gut microbiome is a dynamic system, influenced by a gamut of factors including stress (Gao et al. 2018), diet (Scott et al. 2013), metabolism (Gomes et al. 2018), age (Maynard and Weinkove 2018), geography (Deschasaux et al. 2018) and antibiotic treatments (Panda et al. 2014). Studies have shown that gut bacteria possess their own daily rhythmicity in a light/dark cycle (Paulose et al. 2016). Human and rodent gut microbiota is majorly composed of two dominant bacterial phyla: Firmicutes and Bacteroidetes that represent more than

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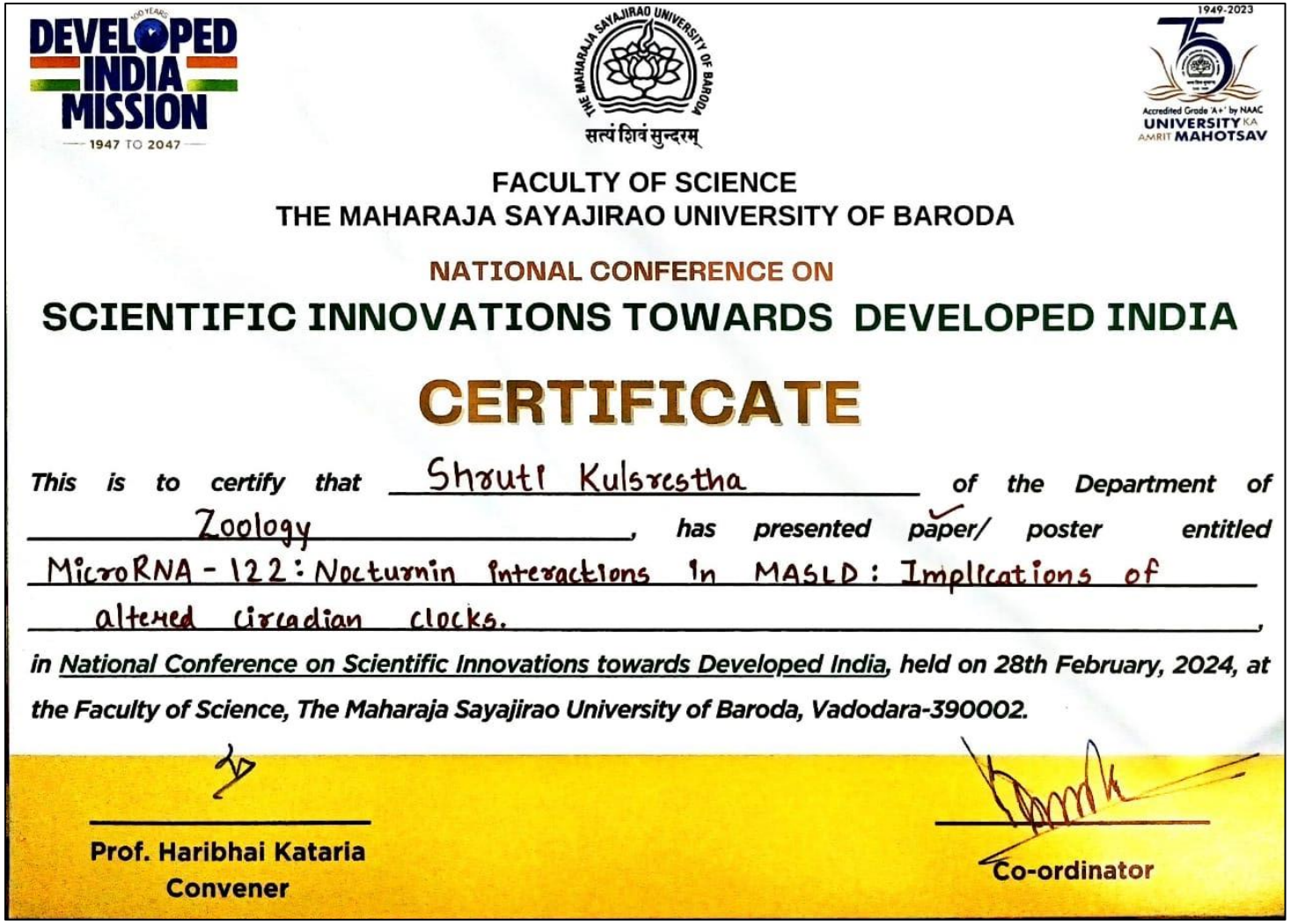
Supplemental data for this article can be accessed online at https://doi.org/10.1080/07420528.2024.2329205.



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This is to certify that Shruti Kulsrestha *of the Department of* Zoology, *has presented paper/ poster entitled* MicroRNA-122: Nocturnin Interactions in MASLD: Implications of altered circadian clocks.,

in National Conference on Scientific Innovations towards Developed India, held on 28th February, 2024, at the Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara-390002.

Prof. Haribhai Kataria
Convener

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This is to Certify that Prof./ Dr./ Mr./ Ms. Shruti Kulsrestha

of Dept. of Zoology, M.S.U., Vadodara has been awarded I/ II/ III Prize in oral/ ~~poster~~ presentation (SRBCE / ~~NUV~~) at the **International Conference on Molecular Medicine, Reproduction and Endocrinology 2023** and 40th Annual Meeting of The Society For Reproductive Biology and Comparative Endocrinology organized by, Division of Biomedical and Life Sciences, School of Science, Navrachana University Vadodara, Gujarat, India between 14th - 16th September, 2023.

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This is to certify that Prof./Dr./Mr./Ms. Shruti Kulshrestha *affiliated to* MSU, Vadodara *has presented a paper (~~Oral~~/Poster) in the International Conference on "Reproductive Biology, Comparative Endocrinology and Development", from 14th to 16th September, 2022 organized by CSIR- Centre for Cellular and Molecular Biology (CCMB) and University of Hyderabad (UoH). It (Abstract No.* P-21 *) was adjudicated as the Best Oral/Poster Presentation (1st/2nd/3rd prize) for the " Prof. N. J. Chinoy best paper award 2022".*

Prof. G. Umapathy
Convenor, CSIR-CCMB

Prof. A.V. Ramachandran
President, SRBCE

Prof. M. Michael Aruldhas
Secretary, SRBCE

CERTIFICATE
OF PARTICIPATION

GeneXplore Diagnostics & Research Centre Pvt. Ltd.

This is to certify that

Ms. Shruti Kulshrestha

has successfully completed

Hands-on training program on

"Basic Bioinformatics"

Jointly organized by Gujarat Biotechnology Research Centre and

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07th - 11th March 2022

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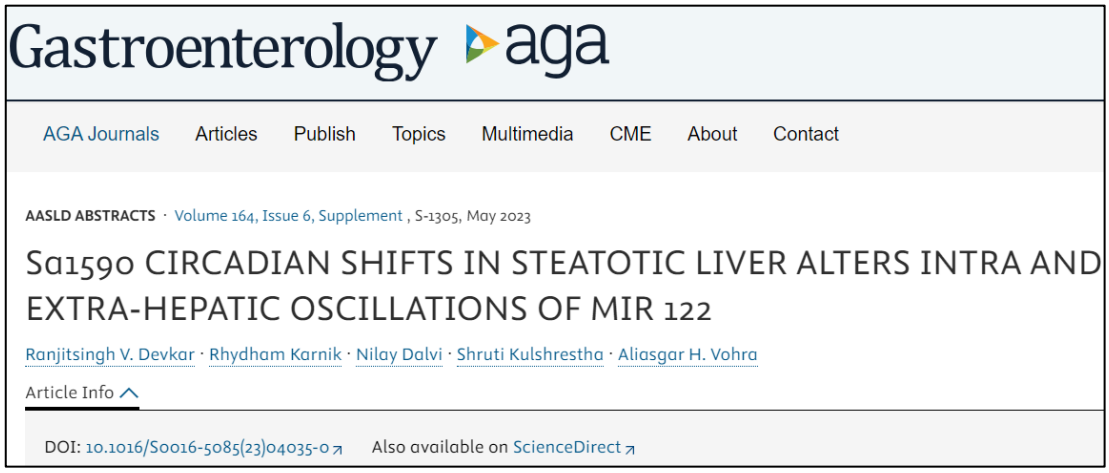

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Sa1590 CIRCADIAN SHIFTS IN STEATOTIC LIVER ALTERS INTRA AND EXTRA-HEPATIC OSCILLATIONS OF MIR 122

Ranjitsingh V. Devkar · Rhydham Karnik · Nilay Dalvi · Shruti Kulshrestha · Aliasgar H. Vohra

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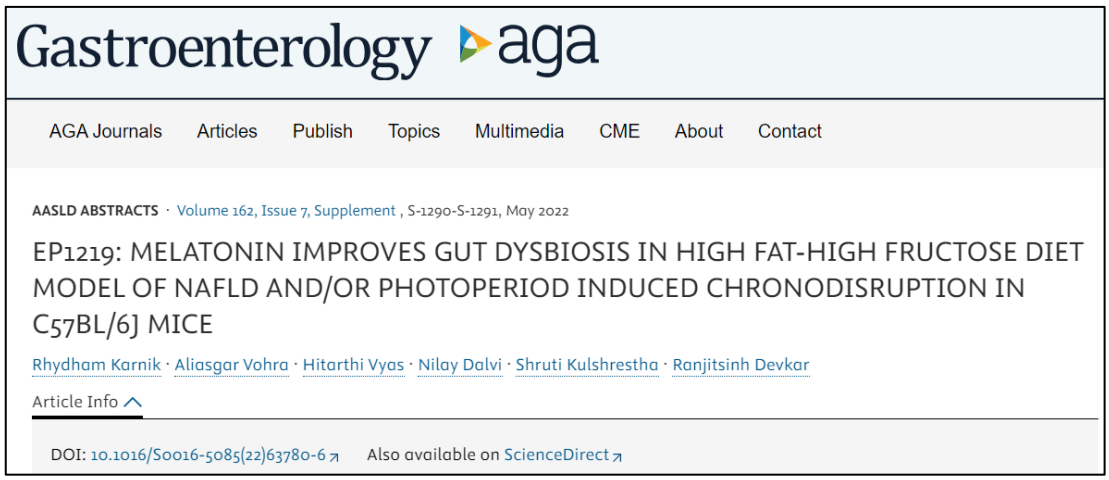

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Rhydham Karnik · Aliasgar Vohra · Hitarthi Vyas · Nilay Dalvi · Shruti Kulshrestha · Ranjitsinh Devkar

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Sa383 EXOGENOUS MELATONIN IMPROVES LIVER FUNCTION AND NEUROBEHAVIORAL DESYNCHRONY IN EXPERIMENTALLY INDUCED LIFE STYLE DISORDER IN C57BL/6J MICE

Aliasgar H. Vohra · Kapil Upadhyay · Apeksha Joshi · Hitarthi Vyas · Shruti Kulshrestha · Ranjitsinh Devkar

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