ACTUS NUTRITION

Animal Health

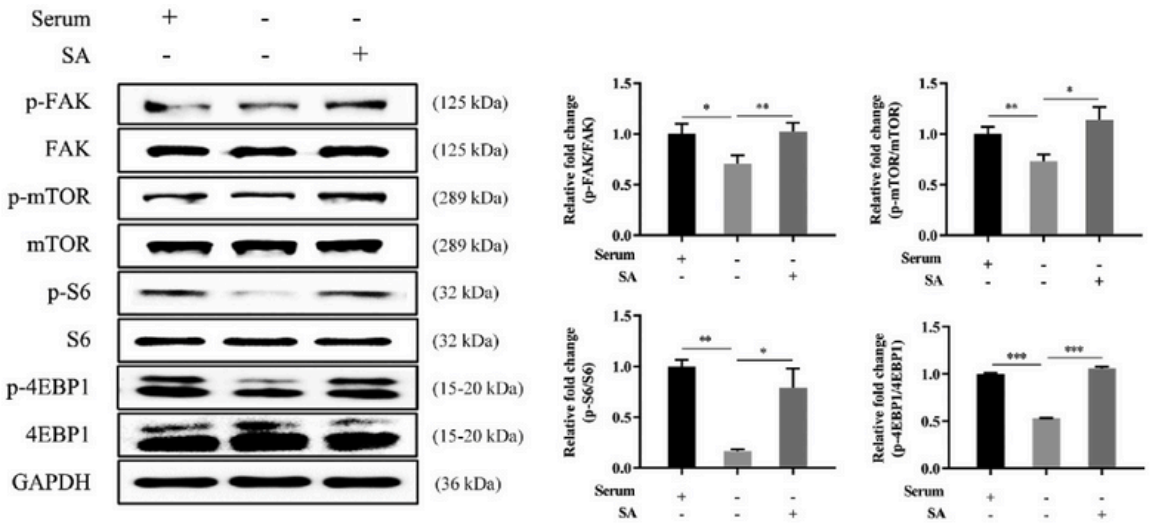
Stearic Acid on Lipid Synthesis

FROM THE MAKERS OF ENERGY BOOSTER AND RPMET™

To determine the effects of SA on lipid synthesis, we treated BMECs by serum starvation for 12 h, followed by 150 μM SA for 24 h, and measured the content of intracellular lipid droplets (LDs) and intracellular and extracellular TAG.

To determine whether SA activates FAK/mTORC1 signaling, we examined the phosphorylation of FAK, mTOR, S6, and 4EBP1 on treatment with SA by western blot. SA significantly upregulated the phosphorylation of these proteins (Fig. 1), indicating that the FAK/mTORC1pathway is activated by SA in BMECs. These data indicate that SA enhances lipid synthesis through FAK/mTOR signaling in BMECs.

Stearic acid (SA) activates FAK/mTORC1 signaling in BMECs. Western blot of the phosphorylation level of FAK (Tyr397), mTOR (Ser2448), S6 (Ser235/246), and 4EBP1 (Thr37/46) after serum starvation and treatment with SA.



ig. 1. Stearic acid (SA) activates FAK/mTORC1 signaling in BMECs. Western blot of the phosphorylation level of FAK (Tyr397), mTOR (Ser2448), S6 (Ser235/246), nd 4EBP1 (Thr37/46) after serum starvation and treatment with SA. The images were quantified using Image J. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$; $n = 3$ ex- eriments. Error bars indicate SD.

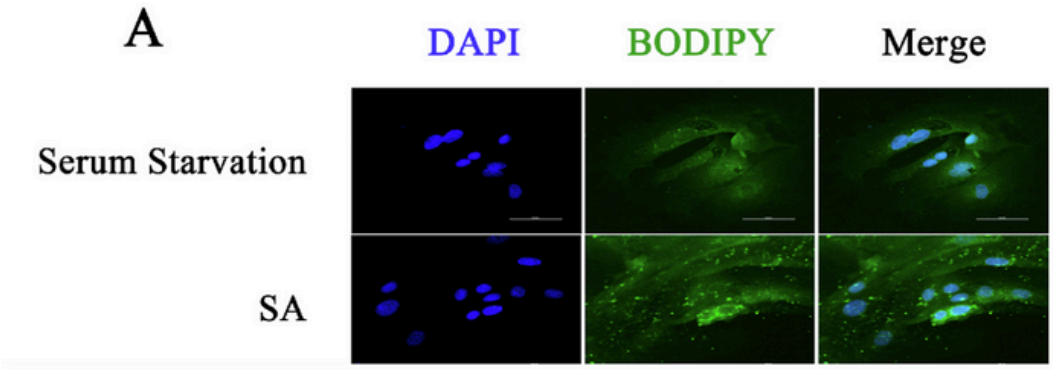


Fig. 2. CD36 mediates stearic acid (SA)-induced lipid synthesis in BMECs. (A) BODIPY®493/503 staining of SA-induced accumulation of lipid droplets on blockade of CD36. (B) Intracellular TAG levels on treatment with SA and blockade of CD36. (C) TAG levels in culture media on blockade of CD36. $^{*}p < 0.05$, $^{**}p < 0.01$; n = 3 experiments. Error bars indicate SD.

Combined with our previous study [36,37], we propose a model in which SA promotes lipogenesis through the potential receptor CD36 and the Fyn/FAK/mTORC1 signaling axis in BMECs.

Several recent studies have reported that SA-enriched supplements, alone or combined with palmitic acid (PA) or oleic acid (OA), enhances adipogenesis and lipogenesis in lactating dairy cows in vivo [45,46] and in vitro [47,48]. Earlier reports have shown that SA-enriched supplements stimulate the accumulation of LDs and TAG synthesis and that mTORC1 signaling regulates lipid synthesis in primary cultured BMECs
[49–51]. Recently, Li et al. (2022) observed that SA activates PI3K/mTORC1 signaling and promotes milk synthesis in BMECs [52].

CD36, also known as fatty acid translocase (FAT), appears to be the Fig. 2. CD36 mediates stearic acid (SA)-induced lipid synthesis in BMECs. (A) BODIPY®493/503 staining of SA-induced accumulation of lipid droplets on blockade of CD36. (B) Intracellular TAG levels on treatment with SA and blockade of CD36. (C) TAG levels in culture media on blockade of CD36. *p <0.05, **p <0.01; n =3 experiments. Error bars indicate SD most important translocator of fatty acids [11] and facilitates fatty acidm uptake by dynamic palmitoylation-regulated endocytosis [16,53]. CD36 is expressed by the mammary glands, responding to LCFAs to improve milk lipid synthesis and hepatic lipid accumulation in dairy cows and
goats [49,54–56]

In this study, SA-induced FAK/mTORC1 signaling, PPARγ expression, and lipid synthesis were impaired by blockade of CD36 with anti-CD36 (Figs. 2, 3). Further, SSO, a CD36-specific inhibitor, downregulated SA-induced FAK/mTORC1 signaling, lipogenic gene expression, and lipogenesis (Fig. 4), with the opposite patterns obtained in CD36-overexpressing cells (Fig. 5). Thus, CD36 acts as a potential receptor of SA in stimulating FAK/mTORC1 signaling and promoting lipid synthesis in BMECs.